Undergraduate Research Forum

Noon-2 p.m. • April 4, 2019 • Lima Campus Library

THE OHIO STATE UNIVERSITY

LIMA

PURPOSE

The Lima Campus Undergraduate Research Forum is designed to encourage students to actively engage in research. Beyond the Lima Campus Forum, participation in the Denman Undergraduate Research Forum, the Spring Undergraduate Research Festival, the University Libraries Research Prize, or publication in JUROS are all strongly encouraged, although faculty and students are welcome to pursue any appropriate forum for their discipline that will showcase undergraduate research.

THANK YOU

We would like to thank Interim Dean Joe Brandesky for his support of this forum. Thanks also to the support given by the Office of Student Life.

2019 UNDERGRADUATE RESEARCH AND MENTORING COMMITTEE

The Ohio State University at Lima Undergraduate Research
Lima.OSU.edu/research/undergraduate-research/undergraduate-research-forum.html

PROGRAM

1. **Ramzy Abukhader** – Within Walls: *A Chapbook of Poetry*
2. **George Bauer** – *Do Forest Refugia and Riverine Barriers Promote Genetic Diversity among Species in the* Hybomys *Division?*
3. **Shivani Bhatt and Alyson Grubbs** – *Grandparent Financial Support, Socioeconomic Status, and Parental Stress*
4. **Michael Blosser** – *Preschooler's Understanding of Internal States and Theory of Mind*
5. **Carissa A. Bonham** – *Habitat Description for* Spiranthes ovalis var. erostellata *at Oakwoods Nature Preserve*
6. **Victoria R. Bradford** – *An Exploration of Hypnotic Responsiveness, Standardized Test Performance, and Academic Ability*
7. **Baylie Brock** – *Habitat Selection Influences Survival Rates in House Wrens*
8. **Rachel A. Crites** – *Intraspecific Variation in the Skulls of West African Soft-furred Mice,* Praomys rostratus
9. **Jackson Dickman, Victoria Smedley** – *PK-9 Male Teachers: Investigating Preservice and Inservice Teacher Perspective*
10. **Olivia Green** – *CAM Therapies: A Survey of Beliefs, Credibility, and Frequency of Use among OSU Students*
11. **Spencer R. Hina** – *Paranormal Beliefs, Locus of Control, and Hypnotizability*
12. **Taylor A. Koenig** – *Time-Series Evaluation of a Healthy Corner Store Intervention*
13. **Colten B. Napier** – *Youth Mental Health and Suicide Associated with Adverse Childhood Experiences: Allen County Youth in 2017*
14. **Parth Patel** – *Comparison of the Survival Rates between Migratory and Resident Birds*
15. **Danielle Schramm, Annie Schramm, and Haley Snyder** – *Synthesis of Glutamate Racemase Inhibitors Via Structure Aided Drug Design*
16. **Amanda K. Weller** – *Systematics and Ecology of the Brush-tailed Mice,* Calomyscus*, Based on Cytb and Rbp3*

ABSTRACTS

Ramzy Abukhader
Faculty Sponsor: Mr. Doug Sutton-Ramspeck (Department of English)

Within Walls: A Chapbook of Poetry

Within Walls, an independent creative project, is a chapbook of poetry that explores the influencers of mental and physical constructs surrounding any individual. Whether the poems explore the influences of government, religion, social class, or the nuclear family, they examine these as metaphorical walls, seeking to deconstruct their layers and to observe the elements within them to convey how they cultivate, restrict, witness, and expose human thought and behavior. Therefore, the poetry often employs "walls" as props that operate as conduits carrying exterior influences and delivering them to the physical realm, regardless of whether those who are the subject find these influences desirable. At times, the walls deliver unexplainable degrees of comfort, such as in "The Table" where a child is shown cornered against a wall by a lion, yet at peace, as "he pressed his sleeping face / against the breathing wall / whispering to it." On the other end of the spectrum, these walls can also be a medium for haunting messages, illustrated in "Genetic Ghosts" where a speaker, who is disturbed by his son's strange interactions with the walls of his house, notices a shadow on the wall in his family photo and sees it reaching toward his son. This strikes memories into his mind "of conversations we had by the wall," which suggest that, somehow, his own habits have been transferred to his son. Beyond the image of a literal wall, other metaphorical symbols are used to illustrate these influences, such as nature, shown in "Jungle Drums" when the speaker describes how "the roots of the ground have synced / To the nerve endings in my flat feet." However, most often, there remains a sense of uniformity and cohesion amongst these other elements, and they form, still, a figurative wall.

George Bauer
Faculty Sponsor: Ryan W. Norris (Department of Evolution, Ecology, and Organismal Biology)

Do Forest Refugia and Riverine Barriers Promote Genetic Diversity among Species in the *Hybomys* Division?

The West African tropical rainforest is an ecosystem rich in biodiversity in a number of forest-dwelling mammals. Multiple hypothesis working in conjunction potential are contributing to this bloom in diversity are the Pleistocene refuge, riverine barrier and African paleoclimatic climate shifts. The aim of this study is to investigate how these geographical barriers and forest fragmentation events affect the relationship within species in the *Hybomys* division. Samples from all the genera in the *Hybomys* division were collected from forested areas in West Africa. More specifically the species being researched are two species well distributed in West Africa from the genus *Typomys* (the Liberian striped mouse, *T. planifrons* and Temminck's striped mouse, *T. trivirgatus*) and the single species in the genus *Dephomys* (the defua rat, *Dephomys defua*). In this study a combination of mitochondrial (cytochrome *b, Cytb*) and nuclear (Interphotoreceptor Retinoid Binding Protein, *Rbp3*) data was used to generate the molecular phylogeny. Our results showed latitudinal patterns between Guinea and Ivory Coast, supporting the two small forest refugia hypothesis. This latitudinal separation in *D. defua* diverged 1.36 Mya [95% HPD 0.76-2.31], following the aridity event from 1.8-1.6 Mya. *T. trivirgatus* diverged 0.88 Mya [95% HPD 0.43-1.57], aligned with the aridity event from 1.0-0.80 Mya. The pattern in *T. planifrons* is not as clear because the Guinea samples were not monophyletic. *T. planifrons* from Guinea and Ivory Coast diverged 0.67 Mya [95% 0.43-1.57], shortly after the aridity event from 1.0-0.80 Mya It is worth noting that the insufficient sample size and lack of sample distribution could affect our ability to detect patterns. Future research could be improved by greater sampling throughout Sierra Leone to better capture migratory patterns and additional Liberia samples to help us understand the role the Cavally River in shaping biodiversity.

Shivani Bhatt and Alyson Grubbs
Faculty Sponsor: Dr. Virginia Tompkins (Department of Psychology)

Grandparent Financial Support, Socioeconomic Status, and Parental Stress

Grandparents often provide financial support to young children and their families, which is related to lower parental stress (Parkes, Sweeting, & Wight, 2015). Limitations of prior research on grandparent financial support include that only single items were used (e.g., Trute, 2003) or only focused on one grandparent relation, often grandmothers (e.g., Musil et al., 2009). The present study utilized a novel 32-item Grandparent Financial Support (GFS) survey, which included an exhaustive list of ways in which grandparents provide support to young children (i.e., 3 to 5-year-olds); additionally, parents answered surveys for *each* grandparent relation. Participants were recruited through ResearchMatch.org and Head Start and included 120 parents (88% mothers) who completed 290 GFS surveys online (one for each single or coupled grandparent involved in the child's life). Parents also reported on their socioeconomic status (SES), completed the Parental Stress Scale (Berry & Jones, 1995), and provided other descriptive information for each grandparent (e.g., physical distance). We hypothesized that the GFS items would separate into at least two conceptually distinct categories. As hypothesized, an exploratory factor analysis confirmed the presence of distinct factors which included: Entertainment and Clothing, Daily Caregiving, Transportation, and Household Expenses. Our second hypothesis was that GFS factors are related to SES, for example that individuals with lower SES will receive financial support for more basic needs as opposed to superfluous financial support. We found this to be true of Transportation and Home Expenses. Our third hypothesis was that parents with greater grandparent financial support would report lower parental stress controlling for third variables such as SES. We did not find support for this hypothesis.

Michael Blosser
Faculty Sponsor: Dr. Virginia Tompkins (Department of Psychology)

Preschooler's Understanding of Internal States and Theory of Mind

Researchers debate the mechanism by which children develop a theory of mind (understanding the internal states of others and one's self). One theory asserts that children develop theory of mind through social interactions in which internal states (e.g., beliefs, intentions) are discussed (Carpendale & Lewis, 2004). This social constructivist approach assumes that children's use of internal states in these parent-supported exchanges explains their gradual mastery of theory of mind; however, the exact mechanisms are unclear (Carpendale & Lewis, 2004). Numerous correlational studies show that parents' internal state talk to children predicts their theory of mind (Tompkins et al., 2018). However, this correlational approach does not specify the mechanisms by which parents' internal states elicit children's own use of this vocabulary or whether the child's ability to respond drives their theory of mind development. To overcome limitations of the correlational approach, we examined the moment-by-moment exchanges between mother and child around internal states using sequential analysis. We hypothesize that when mothers use an internal state, preschoolers' responses may not contain the internal state, but they will be more likely than chance to respond in a way that indicates their correct interpretation of the internal state. We further hypothesized that children's ability to respond to a mother's references to an internal state appropriately will predict growth in theory of mind. Participants included 25 4- to 5-year-olds (M = 4.5 years) and their mothers. At Time 1, the mother-child dyads were observed narrating the wordless book *Rainstorm* (Lehman, 2007). Children's theory of mind was tested at twice, six months apart, such that we can examine growth over this time. In support of the first hypothesis, children were significantly more likely than chance to respond contingently. However, their responses to mothers' internal states did not predict theory of mind.

Carissa A. Bonham
Faculty Sponsor: Dr. Jackie Augustine (Department of Evolution, Ecology, and Organismal Biology)

Habitat Description for *Spiranthes ovalis var. erostellata* at Oakwoods Nature Preserve

In order to protect and preserve rare plants, managers need to know what environmental conditions are necessary for a particular species of plant. The *Spiranthes ovalis var. erostellata* is a rare species of orchid that seems to tolerate a variety of soil types. Recently, a small population of *S. ovalis* was discovered at the Oakwoods Nature Preserve in Hancock County, Ohio. We conducted transects that cover all possible habitats in the park in order to determine the distribution of the *S. ovalis* and to determine soil characteristics associated with the occurrence of *S. ovalis*. Soil samples were taken in each orchid patch and at two locations along each transect without an orchid patch to determine soil characteristics tolerated by the orchid and to identify potential sites for establishing new populations. Percent cover of canopy, understory, herbaceous layer, litter cover, and bare ground (PCA) were also taken when obtaining the soil samples. The samples were weighed then allowed to dry for one week to allow for evaporation of moisture then reweighed to calculate the percent moisture. The samples were also tested for pH, nitrogen, phosphorus, and potassium. Nitrogen and phosphorus showed little variability across all samples. Overall, *S. ovalis* occurred where percent of moisture was high, herbs and litter cover were high, and bare ground and canopy were low. Three sites were identified as potential sites for establishing new populations. Future work should examine the genetic diversity of this small, isolated population to determine if inbreeding is limiting the size and health of the population.

Victoria R. Bradford
Faculty Sponsor: Dr. Joseph P. Green (Department of Psychology)

An Exploration of Hypnotic Responsiveness, Standardized Test Performance, and Academic Ability

Early research suggested small positive associations between hypnotic responsiveness and intelligence (e.g., Hull, 1983). Geiger, Peter, Prade, and Piesbergen (2014) obtained a positive correlation between hypnotizability and intelligence among their female students but a negative association among their male students. West (2003) reported negative correlations between academic achievement and hypnotic responsiveness among 58 undergraduate students. Our study set out to explore potential associations between hypnotic responsiveness on the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A; Shor & Orne, 1962), standardized test scores on the ACT, and academic performance. In addition to hypnotizability, N=139 undergraduate students completed the Tellegen Absorption Scale (TAS; Tellegen & Atkinson, 1974), the Dissociative Experiences Scale (DES; Burnstein & Putnam, 1986), Inventory of Childhood Memories and Imaginings (ICMI; Wilson & Barber, 1983), and three items pertaining to the expectancy of being hypnotized. Our main finding was a significant negative correlation between the HGSHS:A and ACT composite scores, r= -.22. High school grade point average (gpa; r= -.14) and first semester college gpa (r= -.11) were also negatively related to hypnotic responsiveness; however, neither correlation reached significance. Results from a stepwise regression analysis showed that scores across two expectancy items (i.e., ratings of how interesting hypnosis will be; and, estimates of the number of items that students thought they would pass during hypnosis), high school gpa, and the ICMI accounted for 45% of the variance in hypnotic responsiveness. We discuss the implications of our results in light of previous findings.

Baylie Brock
Faculty Sponsor: Dr. Jackie Augustine (Department of Evolution, Ecology, and Organismal Biology)

Habitat Selection Influences Survival Rates in House Wrens

An organism's selection of habitat plays a vital role in their physical development and survivorship. A multitude factors contribute to this decision, including the quality of the habitat or the presence of predators. We asked whether habitat choice affects the survival of house wrens (*Troglodytes aedon*). We compared the survival of two populations occupying nest boxes at a golf course (Hawthorne Hills Golf Course) and a deciduous forest (Tecumseh Natural Area). We estimated apparent survival using 6 years (2011-2015) of mark/re-sighting data with a muti-strata model using the codes 0=not present, 1=single nest, and 2=two or more nests for each year. We determined that wren survival did not vary by location, but did vary by age class. Transition probabilities from two or more nests to 1 nest was higher than transition probabilities from 1 nest to 2 or more nests, suggesting a cost of reproduction. Our results suggest that house wrens tolerate a variety of habitats, and are able to select areas within each habitat that provide adequate resources to ensure survival.

Rachel A. Crites
Faculty Sponsor: Ryan W. Norris (Department of Evolution, Ecology, and Organismal Biology)

Intraspecific Variation in the Skulls of West African Soft-furred Mice, *Praomys rostratus*

The West African Soft-furred mouse, *Praomys rostratus*, is a rodent species restricted to the rainforest belt in westernmost Africa from Côte d'Ivoire through Senegal. *Praomys rostratus* is a generalist rodent, which means it can live in many microhabitats that differ in nutrients, shelter, predation, and competition. My research uses many techniques to study morphological features dependent on ecological, geographical, and ontogenetic variation. Our initial work at Ohio State Lima has shown that five external features (total length, tail length, hind tarsus length, ear length, and weight) displayed no significant size difference between locations in Sierra Leone and Guinea, West Africa. Meanwhile, my research at The Field Museum of Natural History, using geometric morphometric analysis (GMM), has shown that the crania and mandible shape of *P. rostratus* significantly varies in correlation with five microhabitat types in Côte d'Ivoire, West Africa. The microhabitats tested include cacao, rubber, fallow, primary forest, and secondary forest. Moving forward, I will use GMM to test the skulls sampled in Sierra Leone and Guinea for a difference in shape based on microhabitat. Specifically, I am looking to place shape differences in the context of geography, ecology, and development and growth. By placing these changes in a broader geographic context, we hope to differentiate between rapid evolutionary change (i.e. change in populations) or developmental change (i.e. change in individuals).

Jackson Dickman, Victoria Smedley
Faculty Sponsor: Dr. Britt Collier-Gibson (Department of Educational Studies)

PK-9 Male Teachers: Investigating Preservice and Inservice Teacher Perspective

Gender discrepancy in the teaching force is a recurring topic in educational discourse. As a male and a female teacher candidate in middle and early childhood, we attempted to investigate teacher candidates' and inservice teachers' perceptions of male teachers that may influence the number of male teachers entering the PK-9 teaching profession.

Olivia Green
Faculty Sponsor: Dr. Pat Carroll (Department of Psychology)

CAM Therapies: A Survey of Beliefs, Credibility, and Frequency of Use among OSU Students

Complementary and alternative medicines (CAM) have been used for thousands of years to treat various illnesses and diseases (e.g., mediation, acupuncture, hypnosis). Although many of these approaches are still popular today, the scientific evidence supporting their use has been questioned (Ernst, Cohen, & Stone, 2004). We set out to survey attitudes and beliefs about a selective group of these therapies among undergraduate students enrolled in psychology classes and graduate students in occupational therapy, school psychology, clinical psychology, and counseling education at The Ohio State University. A total of 146 students participated in our survey and completed the CAM Health Belief Questionnaire (CHBQ; Lie & Boker, 2004). The majority of our sample participants (n=137/146) also rated the credibility of 11 different CAM therapies and reported their frequency of using each approach. Mean scores on the CHBQ total scale score did not differ by gender or college status. We found differences on several individual CHBQ items between our undergraduate and graduate students. We found a correlation between CHBQ total scores and total frequency scores, supporting our prediction that those who hold stronger beliefs about CAM are more likely to use various CAM approaches. As predicted, female students reported using CAM therapies more frequently than male students. Specifically, they were more likely to use massage, herbs/vitamins, aromatherapy/essential oils, and yoga. Within our sample, approximately two-thirds of students reported using spirituality/religion and herbs/vitamins approaches. Among our 11 CAM therapies, yoga and meditation both ranked highly in terms of credibility to affect both physiological and psychological processes within the human body. We discuss our findings in light of other research.

Spencer R. Hina
Faculty Sponsor: Dr. Joseph P. Green (Department of Psychology)

Paranormal Beliefs, Locus of Control, and Hypnotizability

Belief in the paranormal (e.g., spirits, extraterrestrials, extrasensory perception (ESP)) is common among members of the public. Atkinson (1994) found a moderate-sized correlation between paranormal beliefs and hypnotic responsiveness among a sample of 43 students. More recently, Elkins and colleagues (2016) reported a link between belief in ESP, magical ideation, fantasy proneness, and hypnotizability as estimated by the Creative Imagination Scale (Wilson & Barber, 1983). Paranormal beliefs also appear to be linked to locus of control (i.e., whether one believes that future events are due to effort or fate; Newby & Davis, 2004). In our study, N=102 undergraduate students completed a series of questionnaires, including the Paranormal Beliefs Scale, Revised (PBSR; Tobacyk, 2004), Internal Control Index (CIC, Duttweiler, 1984), Magical Ideation Scale (MIS; Eckblad & Chapman, 1983), and God Locus of Health Control Scale (GLOHC; Wallston, et al., 1999). In a separate testing session, we administered the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A; Shor & Orne, 1962), along with additional measures of personality. Scores on the GLOHC, MIS, and the PBSR, along with a measure of expectancy to being hypnotized, positively correlated with hypnotic responsiveness. As predicted, we observed a negative correlation between internal locus of control and responsiveness on the HGSHS:A; however, the magnitude of the correlation failed to reach significance. Our findings replicate and extend those reported by Elkins et al. (2016) by showing an association between paranormal beliefs, magical ideation, and hypnotizability.

Taylor A. Koenig
Faculty Sponsor: Dr. John R. Snyder (School of Health and Rehabilitation Sciences)

Time-Series Evaluation of a Healthy Corner Store Intervention

Access to fresh fruits and vegetables is a barrier to healthy eating for residents of food deserts. One intervention which shows promise is the "conversion" of local corner (convenience) stores to offer fresh produce. A time-series evaluation of four converted corner stores, termed "healthy corner stores", was conducted to assess: 1) if food purchasers increase their consumption of fresh produce because the corner store now sells these items; 2) how many servings of fruits and vegetables are corner store customers eating daily; and 3) to what extent does the corner store conversion result in more individuals purchasing healthy foods. Intercept surveys of a cross-sectional, convenience sample were conducted twice at each corner store, approximately four months apart. During follow-up #1, 188 surveys were completed; in follow-up #2, 179 surveys were completed, for a total of 367 surveys. Results showed that 49.5% of respondents in follow-up #1 ate more fruits and vegetables since the corner store was converted, increasing to 52.7% in follow-up #2, although the increase was not significant. Since 5 or more daily servings of fruits and vegetables are recommended, responses were aggregated at 2 or more servings. In follow-up #1, 39.5% ate 2 or more servings of fruit and 50.8% ate 2 or more servings of vegetables. Both of these declined in follow-up #2: fruits to 35.7% and vegetables to 43.0%. Similarly, the number of shoppers who purchased healthy foods after the store conversion declined. No favorable maturation effect was observed. Perhaps follow-up #1 benefited from the novelty of access and follow-up #2 suffered from the intransigent nature of habits. Caution must be exercised in interpreting the results since these are self-reported data, individuals may have differing perceptions of serving size, and the data may reflect seasonal influence.

Colten B. Napier
Faculty Sponsor: Dr. John R. Snyder (School of Health and Rehabilitation Sciences)

Youth Mental Health and Suicide Associated with Adverse Childhood Experiences: Allen County Youth in 2017

Periodically, health-related organizations in Allen County conduct a Community Health and Needs Assessment. This written survey of a cross sectional sample of youth in grades 6-12 uses standardized questions from the Youth Risk Behavior Surveillance System. The County survey, conducted in 2009, 2014, and 2017, included items about mental health and suicide. In 2017, it also included identification of youth-reported adverse childhood experiences (ACEs.) This study used these secondary data to identify: (1) trends over the past 8 years regarding youth mental health and suicide; (2) current causes of anxiety, stress, and depression, and youth behaviors associated with contemplated suicide; and (3) adverse childhood experiences associated with specific normal or risky behaviors. Across the three assessments in 8 years, similar percentages of youth reported feelings of sadness and hopelessness ranging from 27-29%. The same was true for seriously considering suicide (13%-18%) and attempting suicide in the past year (5%-8%). In 2017, survey results were from a randomly selected group of 420 students. The top four causes of anxiety, stress and depression were: (1) academic success; (2) death of a close family member or friend; and (3) fighting with friends. Youth behaviors associated with contemplating suicide include being bullied in the past year and experiencing 3 or more adverse childhood experiences. Twenty-eight percent of youth reported 3 or more ACEs. Thirty-three percent of students who reported 3 or more adverse childhood experiences seriously considered attempting suicide in the past 12 months and 17% attempted suicide in the past 12 months. Youth mental health can affect all aspects of health, social development, and well-being. Identifying specific sources of anxiety, stress and depression and associated behaviors is a first step in addressing youth mental health during these critical years.

Parth Patel
Faculty Sponsor: Dr. Jackie Augustine (Department of Evolution, Ecology, and Organismal Biology)

Comparison of the Survival Rates between Migratory and Resident Birds

Knowledge of survival rates is critical for understanding population change for any species. Migratory species may have lower survival rates than resident species due to the physiological stress of migration and movement through unfamiliar habitat. In this study, we compared the apparent annual survival rate of migrant Gray Catbirds (*Dumetella carolinesis*) and resident Northern Cardinals (*Cardinalis cardinalis*). We analyzed eight years (2010-2017) of bird banding data in west-central Ohio using robust design mark-recapture analyses. We caught 51 Northern Cardinals and 146 Gray Catbirds. Survival varied from year to year, and Gray Catbirds had a marginally higher survival rate as compared to Northern Cardinals. Lastly, we saw differences in species regarding to emigration, immigration, and capture probability, with Northern Cardinals having higher values than Gray Catbirds. Contrary to other studies, our study found that migrants had a higher annual survival rate compared to residents, but the relationship was weak. Future studies should seek to determine what environmental variation may lead to yearly differences in survival.

Danielle Schramm, Annie Schramm, and Haley Snyder
Faculty Sponsor: Dr. Swathi Mohan (Department of Chemistry)

Synthesis of Glutamate Racemase Inhibitors Via Structure Aided Drug Design

The emergence of antibiotic resistance in pathogenic microbes has led to the increasing focus on development of novel antimicrobial agents and identification of new drug targets. Glutamate racemase (GluR) is one such specific target because the enzyme is involved in early stages of cell wall synthesis. GluR catalyzes the inversion of L-glutamate to D-glutamate using two conserved cysteine amino acid residues in the active site of the enzyme. In 2002, discovery of new class of substrate-based inhibitors and 4-substituted D-Glu analogues by researchers at Eli Lilly has shown promising antibacterial activity for GluR. These researchers used the enzyme *MurI* isolated from E.coli to test for antibacterial activity. Molecular modeling studies and chemical library searches has given some promising lead compounds.

Amanda K. Weller
Faculty Sponsor: Ryan W. Norris (Department of Evolution, Ecology, and Organismal Biology)

Systematics and Ecology of the Brush-tailed Mice, Calomyscus, Based on Cytb and Rbp3

Family Calomyscidae is a group of muroid rodents consisting of the single genus *Calomyscus*. They are small pale colored mice with large ears and tufted tails. *Calomyscus* prefer dry rocky mountainsides with sparse vegetation and are found in South Central Asia. Populations tend to be isolated due to uneven habitat. Currently only eight species are recognized based on morphological characteristics and phylogenetic analyses. *Calomyscus* can be informally separated into three species groups; this project focuses on one of these, the *C. bailwardi* species group. This group contains three of the eight recognized species, *C. baluchi, C. hotsoni*, and *C. bailwardi*, which are distributed in Iran, Afghanistan, and Pakistan. We analyzed how species present in this group are related and investigated potential species suggested by other datasets. Cytochrome b (Cytb) sequences were obtained from 229 individuals and a phylogenetic tree was constructed to test relationships among species. Interphotoreceptor retinoid-binding protein (Rbp3) sequences were obtained from 30 individuals and a maximum parsimony network was constructed. The Cytb tree suggests up to six species, more than the recognized three. Specifically, both *C. baluchi* and *C. bailwardi* appear to be comprised of more than one species. The Rbp3 network supports these distinctions, but less robustly. Ecological niche modeling indicates habitat requirements for the suggested species are different.

Undergraduate Research Forum 2019