

ACS Faculty Renewal Grant Final Report

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“Crossing boundaries: Psychology meets Biochemistry Linking animal behavior with reproductive success”

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\$8,000

1. Goals and Anticipated Outcomes. The goal of this project was to create an interdisciplinary undergraduate research experience by uniting psychology and biochemistry, thereby broadening the scope of undergraduate research and increasing scholarly productivity. Specifically, *the objective of this research was to investigate genetic and biochemical factors that may contribute to reproductive success using an animal model.* The major anticipated outcome was to obtain data to validate our scientific hypothesis. Extensive laboratory experiments were conducted involving both behavioral observations and biochemical assays. In addition, the results from this study as well as our insights into creating an interdisciplinary undergraduate capstone course would be presented to various audiences.

2. Revised Goals: Due to issues with faculty websites, we were not able to track the research on a website dedicated to this project. However, a summary of this research is included on the Animal Behavior webpage (<http://www.southwestern.edu/departments/animalbehavior/faculty>). Because we are at the final stages of this project and the course will end in May, we chose to hold the faculty forum to discuss our experience with this project after its completion this Fall.

3. Accomplishments. Our major project goals were successfully completed during the past year. Five undergraduate students majoring in Animal Behavior or Psychology completed this interdisciplinary project under the guidance of Dr. Fay Guarraci and Dr. Maha Zewail-Foote. Female rats were mated with two males simultaneously in a mate choice paradigm and male and female sexual behavior was observed and analyzed. Each family produced approximately 10 offspring. In order to examine how behavior relates to reproductive success, the paternity of each offspring was determined by genetic analysis. Extracted genomic DNA from the mother, two potential fathers, and offspring was subjected to microsatellite analysis and the paternity of each offspring produced during mating sessions was determined. In addition, testosterone was quantified from collected rat urine using a competitive enzyme-linked immunoassay (EIA) and normalized to levels of creatinine to account for differences in urine production. This will allow us to assess the relationship between reproductive success of particular male rats in a pair and basal testosterone production.

Based on the research conducted during the last year, we presented some aspects of the data at two venues thus far: Southwestern University Creative Works Symposium and Southwestern Comparative

Psychology Association (SCPA; a regional meeting of the American Psychological Association). One student who participated in this research was awarded second place for best student presentation at the meeting in Dallas in April 2010 (SCPA). In addition, two abstracts have been submitted for conference presentations at the upcoming annual meeting of the Society for Neuroscience. Finally, we are in the process of finalizing these results and we expect to submit two manuscripts from this research for publication.

4. *Evaluation and Assessment.* A questionnaire, with 25 items, was given to participating students to assess attitudes and experiences working on this interdisciplinary project. Overall, students gained in many intellectual areas. Specifically, questions assessed intellectual gain in: technical skills, understanding the research process, career development, trouble-shooting skills, working independently, confidence as a scientist, designing experiments, interpreting results/statistics and understanding the literature. On a scale of 1-5, with 5 being “very large gain”, the average of the responses on all questions across all students was 4.58. Here are a few specific comments from students:

“I learned so much during my research experience, and I especially loved the interdisciplinary nature of the project.”

“ I learned many new techniques, became well-versed in the area of primary literature, improved my scientific writing and presentation skills, and solidified my desire to go to graduate school to continue doing research.”.

“This course brought me a sense of confidence in research, and a sense of pride at our accomplishments. I feel very lucky and honored to have had such an amazing experience. I feel that I am at an advantage for graduate school when compared to other students who have not taken this course. The wide variety of research skills that I have been taught is very appreciated. “

“This course was instrumental in helping to develop my scientific writing, thinking, and skills.”

5. *Lessons Learned.* Overall, this project was successful and two lessons were learned that will inform future interdisciplinary projects. 1) In the future, a biochemistry tutorial may be helpful for those who have not taken an upper-level Biochemistry course . The undergraduate students participating in this research were psychology or animal behavior majors enrolled in the year long capstone course. Several of these students, but not all, had taken the first semester Biochemistry and its corresponding laboratory course. Therefore, not all students had the same foundation in chemistry. 2) Measuring urinary testosterone is advantageous because it more closely reflects basal levels of hormone production over 12-24 hours and is non-invasive.

6. *Impact on Faculty at Southwestern University.* The main aspects of the project impacted two faculty members (both of the P.I.s on the project). We both have learned vital information that broadened our scientific knowledge. In addition, we will be able to publish two manuscripts in peer-reviewed journals this year, as well as submit abstracts to a variety of scientific forums. These accomplishments will greatly support our goal of achieving the rank of full professor in the next few years. Finally, some of the results from this project will be used in a grant proposal to National Institute of Health which will be submitted by Guarraci and Zewail-Foote this year.

7. *Impact on Southwestern University.* Because faculty and students directly involved in this project were greatly affected by the project, the university as a whole benefited. However, in addition to these direct effects of the project, the larger community will be affected by the project as a consequence of the presentation we have scheduled for the Fall 2010. This presentation will be open to all members of the community and will focus on how to start, maintain, and complete successful interdisciplinary research with undergraduates.

8. *Impact on Students*. Conducting research on an interdisciplinary project broadened our students' research experiences. In addition to the students who received monetary support from this grant, three other students participated in different aspects of the project during the year. The results from our assessment show that the students gained much from the experience. The students involved in the project had the opportunity to present the scientific results at a symposium at the annual meeting of the Southwestern Comparative Psychology Association (SCPA) in Dallas, Texas (April 8-10). In addition, these results as well as the logistics behind cultivating this type of project were shared with psychology professors Melissa Burns-Cusato, Brian Cusato from Centre College and their undergraduate students, who were in attendance at this meeting. By meeting with this research group at the regional conference, we were able to reduce travel expenses to Kentucky.

9. *Dissemination*. This research was presented at SCPA and to a research group from Centre College who was also at the meeting. In addition to this presentation, two abstracts have been submitted to the annual meeting of the Society of Neuroscience, which is scheduled for November in San Diego, CA (See above). We plan to submit two manuscripts for publication in peer-reviewed journals.

10. Manuscripts are in preparation, but abstracts have been published.

Abstracts:

Jessica Bolton presented "*Who's your daddy?*": *Kin recognition and mate choice* at Southwestern Comparative Psychology Association 2010 Dallas, TX (won 2nd place for Best Student Presentation) as well as at the Creative Works Symposium at Southwestern University

Jessica Bolton, Carissa Winland, Brittany Ford, Jade Tinker, Maha Zewail-Foote and Fay A. Guarraci "*Who's your daddy?*": *Kin recognition and mate choice in the Long Evans rat* submitted abstract 2010 Annual Society for Neuroscience Meeting in San Diego, CA

Carissa Winland, Jessica Bolton, Brittany Ford, Sumi Jampana, Fay A. Guarraci, and Maha Zewail-Foote "*Nice Guys Finish Last*": *Mate choice, reproductive success and testosterone in the Long Evans rat* submitted abstract 2010 Annual Society for Neuroscience Meeting in San Diego, CA

Manuscripts in Preparation:

Jessica Bolton, Carissa Winland, Brittany Ford, Sumi Jampana, Jade Tinker, Maha Zewail-Foote and Fay Guarraci. "*Who's your daddy?*": *Kin recognition and mate choice in the Long Evans rat*

Carissa Winland, Jessica Bolton, Brittany Ford, Sumi Jampana, Fay Guarraci and Maha Zewail-Foote, "*Nice Guys Finish Last*": *Mate choice, reproductive success and testosterone in the Long Evans rat*

11. *Future direction*. Our collaboration will continue so that we can extend these studies to examine other factors that may influence mate choice, reproductive success, and kin recognition. We hope to submit a grant proposal to NIH this Fall so that we can further investigate genetic differences between rats with high levels of reproductive success and attractiveness to the opposite sex.

12. Budget Information: See attached

13. *Summary:* Over the past year, five students have completed an interdisciplinary research project under the guidance of Dr. Maha Zewail-Foote and Dr. Fay Guarraci. By combining behavioral observations with biochemical assays, we were able to advance the understanding of mate choice and reproductive success. Female rats were mated with two males simultaneously in a mate choice paradigm. Paternity of the offspring produced during the mating sessions was determined for each offspring by microsatellite analysis. In addition, urinary testosterone levels were quantified to assess the relationship between reproductive success of a particular male rat in a pair and basal testosterone production. Testosterone measurements were normalized to levels of creatinine to account for differences in urine production. Male and female sexual behavior was observed and analyzed as well as preferences of offspring for parents to assess kin recognition.

Attach budget sheet