

# Warren J. Baker Endowment

*for Excellence in Project-Based Learning*

# Robert D. Koob Endowment for Student Success

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## FINAL REPORT

*Final reports will be published on the Cal Poly Digital Commons website  
(<http://digitalcommons.calpoly.edu>).*

### I. Project Title

The effect of hormones and hormonal contraceptives on the antibiotic resistance of *Escherichia coli*

### II. Project Completion Date

The project has not yet fully been completed. Rianna will continue to work on the project during the 2017-2018 academic year. Chase has finished his part in the project and will be graduating June 2017.

### III. Student(s), Department(s), and Major(s)

- (1) Chase Bowen, College of Science and Math, Molecular and Cellular Biology
- (2) Rianna Flores, College of Science and Math, Molecular and Cellular Biology

### IV. Faculty Advisor and Department

Dr. Jennifer Vanderkelen, Center for Applications in Biotechnology  
Dr. Alejandra Yep, Biological Sciences  
Dr. Chris Kitts, Biological Sciences and Center for Applications in Biotechnology

### V. Cooperating Industry, Agency, Non-Profit, or University Organization(s)

Laboratory space at the Center for Applications in Biotechnology  
Donation of fecal samples by females of the Cal Poly student body

### VI. Executive Summary

Main Conclusions (Experiment 1- Hypothesis: Induction of efflux pumps by hormone)

- The growth rates of wild-type and K12 *E. coli* strains are significantly inhibited by the presence of ciprofloxacin. The addition of 100ug/ml hormone slightly reduced the growth in the presence of antibiotic which suggests that hormone does not induce or activate efflux pumps.
- The 0.0015ug/ml ciprofloxacin concentration used in this experiment was too low for CFT073, a uropathogenic strain, but 0.003ug/ml did cause some growth inhibition. Growth with and without hormone was essentially the same suggesting that the higher efflux activity of CFT073 could rid the cells of growth inhibiting hormone.
- The loss of efflux activity in the CFT073 $\Delta$ tolC mutant made it much more sensitive to ciprofloxacin than it's CFT073 parent. The presence of hormone very slightly increased growth of this mutant suggesting that sequestration of antibiotic and hormone perhaps induced activity of a tolC-independent efflux pump.

Main Conclusions (Experiment 2- Hypothesis: Selection for higher efflux pumps by hormonal contraceptive users)

- There was no significant difference between the minimum inhibitory concentrations to ciprofloxacin between *E.coli* isolated from hormonal contraceptives users and *E. coli* isolated from non-users.

It was founded that the protocol for Experiment 1 had a few complications that needed to be addressed. It is unknown as to whether or not the glucuronidated hormone is active once brought into solution or if it is even being uptaken by *E. coli* isolates. This may explain negative results. Future work entails further elucidating this by conducting a growth curve assay of specific *E. coli* strains which will be driven to become dependent on this glucuronidated hormone as an energy source. Additionally, future work entails repeating Experiment 1 as a whole.

## VII. Major Accomplishments

- (1) Mastering laboratory techniques such as isolating bacterial colonies, minimum inhibitory concentration assays, growth curve assays, statistical analysis, and protocol writing.
- (2) Completion of Chase Bowen's Senior Project.
- (3) Poster presentation at the College of Science and Math annual research conference.

## VIII. Expenditure of Funds

Baker Koob Endowment funds were used to fund the materials in this research project. Without this funding, obtaining the necessary materials such as the glucuronidated hormone, microtiter plates, troughs, and pipet tips would have been extremely difficult to obtain. These materials allowed for us to conduct our experiments in a timely manner.

## IX. Impact on Student Learning

Rianna Flores:

Conducting research under the supervision of Dr. Vanderkelen, Dr. Yep, and Dr. Kitts has given me insight into what I want to do in this world: become a physician-scientist. This means dedicating my life to the discovery and application of new knowledge to reach one goal: to improve human health. By working on a project that has broad implications for women's public health and addresses a crucial issue in the field of microbiology, antibiotic resistance, I am able to feel more confident in my career goal. In the future, I hope to conduct microbiology research that also concerns cancer, for example, the use of immunotoxins for cancer therapy; however, I am open to all other areas so long as I feel that my research will overall benefit others.

Nevertheless, one of the most important steps to becoming a physician-scientist is first getting accepted into a MD-PhD program. I believe having received the Baker Koob Endowment will not only enhance my career objective through providing me with a funded research experience, but will also give me an advantage against my competitive counterparts in the application process for the MD-PhD program, thus helping me achieve my overall academic and career objectives. Additionally, receiving the endowment has allowed me learn the necessary knowledge and laboratory techniques that is currently helping me become a successful scientist. I have gained a greater sense of professionalism through working with my professors and by participating in a poster presentation. Lastly, I feel eternally grateful for this very generous opportunity I have been given during my undergraduate studies here at Cal Poly.

Chase Bowen:

Through the kind support of the Baker-Koob Foundation and guidance from faculty, I was exposed to the potentials and opportunities of scientific research. The genesis for my passion in

medicine and research prospered during my tenure as an undergraduate researcher and, the experience was maximized through the support of the Baker-Koob grant. As a student, I recognized that learning material combined with practical application provides a comprehensive approach to understanding concepts. My laboratory experience has afforded me an opportunity to apply the knowledge I have learned in the classroom into tangible experiments--an extremely invaluable skill. The aide from the Baker-Koob grant not only helped achieve our laboratory research, but it also gave me an opportunity to understand grant writing--a valuable skill for my future. Although my career goals have wandered over the course of 4 years, I am excited to attend the University of Southern California's Keck School of Medicine, this Fall, to earn a degree in Cancer and Stem Cell Biology. It is my hope to someday use stem cells to treat and prevent the onset of diseases like brain, pancreatic and liver cancers. I am forever grateful for the Cal Poly community and the foundation I was provided to point me in the right direction for success as a scientist and most importantly, a member of society.