Molecular Biology Research Immersion Program

Program Information

**Dates:** July 8th - August 17th, 2019 (8 Weeks, 2 sessions per week); Student Seminar Symposium – Sat, August 17th 9AM-12:30PM

**Meetings:** Mon & Th 3:30 PM – 7 pm (16 sessions + Saturday, August 17th symposium)

**Location:** San Diego Science Center, 3030 Bunker Hill St, San Diego, CA 92109

**Tuition:** $

**Application Deadline:** July 5th, 2019 (Space is limited, and students will be accepted on a rolling basis)

Our Molecular Biology Research Immersion Program offers four projects: Aging and Protein Aggregation, Endocrine Disruption of Embryogenesis, Ecological Biodiversity and Molecular Phylogenetics, and Fruit Fly Gender-Specific Gene Activity During Stress. All projects involve fieldwork, fundamental molecular biology topics, modern laboratory techniques, and relevant bioinformatics and statistical applications. Learn to synthesize life science fundamentals, review literature, formulate hypotheses and design experiments, collect and process samples, execute experiments, analyze data, and showcase your work through a poster presentation attended by local scientists and industry leaders. Our program fosters opportunities for collaboration, internships, and career advancement.

**Research Project #1: Aging and Protein Aggregation:** Premature aging is a major risk factor for physiological changes underlying diseases. Protein aggregation associated with aging disturbs the cellular environment and may contribute to an onset and progression of age-related diseases. In this study, we try to discover pathways through which protein aggregation could induce or facilitate the decline of cellular functions; we also explore methods to counteract the damaging effects of the aggregated proteins. Students will learn to maintain the roundworm *Caenorhabditis elegans* and use it as a model organism for this study. We will utilize bioinformatics tools, microscopy, fluorescent tagging and perform qPCR, western blotting, and ELSA to quantify gene-related activity and protein synthesis. Our data will be translated into corresponding biological relevance and help us better understand the biology of aging.

**Research Project #2:** Endocrine Disruption of Embryogenesis. Endocrine disruptors are chemicals that mimic hormones and interfere with our endocrine system, potentially causing systemic adverse effects on human health. Even at low doses, endocrine disruptors can be detrimental to animal
embryo and fetal development. Residential San Diego aquatic environments linked to the San Diego River are polluted with runoff and urban waste. Our study focuses on the estrogenic effects of environmental samples from Forester Creek, a historically polluted tributary to the San Diego River. Student will collect environmental samples, quantify estrogenic compounds, and study their physiological effects on zebrafish \textit{(Danio rerio)} embryos. During their research immersion experience, students will engage in zebrafish husbandry and embryo culturing, perform chemical analysis, utilize microscopy to determine cellular and histological changes in zebrafish embryos, and identify statistically significant gene expression changes using qPCR analysis to better understand potential effects of estrogenic compounds in our environment.

**Research Project #3: Ecological Biodiversity and Molecular Phylogenetics:** In collaboration with National Park Services at Carrillo National Monument, we have launched an effort to determine the genetic robustness of the \textit{Agave shawii shawii} species. Shaw’s Agave suffered habitat loss along the Border Crossing due to construction of the border fence. Various other factors (topography, pests, soil chemistry, microbial diversity, and long reproductive cycles) may also have contributed to the population’s decline. We will collect plant tissue and soil samples from Cabrillo National Park to determine plant and microbial genetic variation. Using biomarker gene sequencing, our goal is to contrast variation within and between four populations of Agave. We will analyze soil, microbial enzyme activity, and genetic diversity of Agave and associated microbes to better understand complex ecological interactions within our ecosystem.

**Research Project #4: Fruit Fly Gender-Specific Gene Activity During Stress:** Simplicity of gene expression data interpretation favors males; hence male lab animals are historically used more frequently in research projects. With this study, we challenge the validity and application of such practices by demonstrating that female and male animals differ in significant ways, even if reproduction is not directly involved. Our study aims to quantify metabolic brain gene expression between female and male fruit flies \textit{(Drosophila melanogaster)} under several stressful conditions and highlight gender-specific coping mechanisms potentially relevant to human health. Students will learn to culture and manage fruit flies, distinguish fly genders and life stages using microscopy, dissect flies, and extract RNA for gene expression analysis. We will perform qPCR to quantify expression of genes involved in metabolic pathways to better understand the gender-specific coping mechanisms during stress.
Program Requirements

- Current 10th - 12th grade (and at least 16 years old)

For questions, you can contact us at (858) 534-0804 or precollege@ucsd.edu.

Application Checklist

- Complete all required fields
- Complete essay questions
- Upload required documents
  o Unofficial transcript showing academic history

* Please note that you will not be able to save the application

Application Deadline: 11:59pm on Friday, July 5th, 2019 (Space is limited, and students will be accepted on a rolling basis)

Student Information

First Name:
Middle Name (optional):
Last Name:
Email:
Confirm Email:
Address:
City:
State:
Zip Code:
Home Phone Number:
Date of Birth:
Gender:
  o Male
  o Female
  o Non-binary
  o Decline to state

Do you require special accommodations?
  o Yes
  o No

If you selected yes, please specify:

Citizenship:
Educational Information

Name of School:
Current Grade Level:
Current Overall G.P.A.
Expected Graduation Date from High School
Type of School Attending
  o Public
  o Private
  o Other:

Ethnicity (optional)
  o African-American
  o Asian
  o Mexican-American
  o Filipino
  o Caucasian
  o Native-American
  o Decline to state
  o Other:

Parent/Guardian Information

First Name:
Middle Name (optional):
Last Name:
Relationship:
Does this parent/guardian have legal custody of the minor?
  o Yes
  o No

Address:
City:
State:
Zip Code:
Cell Phone:
Home Phone:

First Name:
Middle Name (optional):
Last Name:
Relationship:
Does this parent/guardian have legal custody of the minor?

- Yes
- No

Address:
City:
State:
Zip Code:
Cell Phone:
Home Phone:

Essay Question

Please explain how biodiversity influences your life. Support your answer with relevant example:
(maximum of 3,500 characters with spaces):

How did you learn about the Boz Institute?
Select an option

- Teacher
- Fellow Student
- Counselor
- Other:

Required Documentations

Please upload your unofficial transcript. Acceptable documents must show your academic history.

End of Application

You've reached the end of the application. Please make sure to submit the application by clicking on "Submit Form." Once that has been completed, you will receive a copy via email. Should you have any questions, please contact the Pre-College Department at (858)534-0804 or precollege@ucsd.edu.