

## Part II: Project Proposal

Project title — Mapping a bang-sensitive gene in *Drosophila melanogaster*

Faculty — Christopher Jones, Associate Professor of Biological Sciences

Student — Kaitlin Raseley

Project duration — 10 weeks, Tuesday May 27 through Monday August 4

### **Description of the project —**

Studying bang-sensitive mutations in the fruit fly *Drosophila melanogaster* has been a long-term focus of my laboratory. Any one of these mutations results in the fly displaying seizures and paralysis upon violent stimulation (e.g. “banging” the container it’s held in, thus the name of the mutant class). Although researchers are still at an early stage in the study of these genetic lesions, they hold promise for better understanding human seizure disorders such as epilepsy.

Only a half-dozen of these mutations have been identified at the level of the gene, a necessary step in understanding the mechanism by which they act. Or perhaps “mechanisms” is more appropriate; the genes that have been identified so far code for proteins with no obvious connecting functional roles; these include citrate synthase (essentially ubiquitous in cells, necessary for energy metabolism), ethanolamine kinase (involved in lipid metabolism), and a structural protein comprising part of the ribosome (crucial for building proteins). Expanding the catalog of these bang-sensitive mutants and identifying the affected genes seems necessary to eventually understanding how these mutations exert their effects.

Although almost all of the known bang-sensitive genes have been mapped and their products identified, ironically the gene affected by the very first bang-sensitive mutation, *bas*, is still unknown. Kaitlin’s project will be to apply the same approaches that Ghazal Stity has successfully used in her SOAR and Honors projects to attempt to map this seminal mutation: recombination mapping to confirm the gene’s general location, deletion mapping to narrow the list of candidate genes, and ultimately transgenic rescue and genome sequencing to confirm the identity of the gene.

### **Roles and responsibilities —**

Kaitlin has the necessary knowledge and skills to succeed with this project: she has taken both Genetics and (currently) Genomics with me. This SOAR project will enable her to synthesize much of what she’s learned and apply her various skills to a single project, an increasingly common skill in modern molecular genetic research. She will be responsible for background research (reviewing the basic molecular genetics she has learned as well as specifics of the bang-sensitive mutants characterized to date), determining and ordering the additional mutant stocks needed for mapping the mutation, and identifying and/or creating the necessary molecular reagents for rescue experiments.

My role will be to guide Kaitlin's background research, coordinate the various aspects of the project, guide her in her initial forays into the various databases she will need to access, and to make suggestions as we discuss strategies, to help her hone her abilities to think and work like a molecular geneticist.

Weeks 1–2: Literature research and review; decide on mapping strategy; order the necessary mapping stocks.

Weeks 3–8: Carry out mapping crosses.

Weeks 8-10: Begin making rescue constructs if possible; begin to prepare for presentation at Scholars Day, the NCUR conference, and the *Drosophila* Research Conference (if appropriate).

### **Student engagement in discipline-appropriate scholarly research —**

The strategies, techniques, and experimental goals of this project are all considered fundamental in *Drosophila* genetics, and indeed are essentially identical to those in genetic studies using other model organisms. Her involvement in all phases of the project, from planning the crosses to carry out to acquiring the data to analyzing them with an eye toward the next step toward our goal, will further strengthen her command of the research process.

### **Student contributions to the discipline —**

Successful completion of this project will add to our understanding of this interesting class of genes, which may someday contribute to improved therapies for human seizure disorders.

Although I don't know whether this SOAR project will produce directly publishable results, I anticipate that they will be more than sufficient to merit presentation at regional and national conferences. In years past my SOAR students have presented their work at the regional Beta Beta Beta convention (Tri-Beta is the undergraduate biology honor society), the National Council for Undergraduate Research conference, and at the national *Drosophila* Research Conference.

## **Part III: Student Statement of Purpose**

Project title — Mapping a bang-sensitive gene in *Drosophila melanogaster*

Student Researcher — Kaitlin Raseley, Biology major, expecting to graduate May 2016

Faculty Mentor — Christopher Jones

Housing requested — yes

My interest in biology began at a very young age and my curiosity has only deepened the further I dig into my undergrad experience at Moravian. I can still remember extracting genetic material out of a strawberry in high school and ever since then I craved more knowledge about the molecular basis of life. DNA is essentially a huge group of

instructions encoded within each organism and without it life would not be possible. It gives every individual organism its own unique traits. Upon entering my first genetics course at Moravian with Dr. Jones I was ecstatic to begin learning about a subject that pertains to all life on earth and any human being can relate to.

Along with biology, I have a passion for medicine and hope on continuing my education after Moravian by attending an M.D. or D.O. program. I have continually been focused on achieving this goal, but as my lab experience progressed I discovered another passion of mine which is research. If I enjoy both there is no reason to hold myself back which is one of the reasons I decided to apply for the SOAR program. After all, without research there would be no medicine or ability to practice it.

Although my curiosity stems mainly from human genetics, most research must begin on a smaller scale model organism. In genetics I was first subjected to this format of study utilizing *Drosophila melanogaster* which is a type of fruit fly. While the majority of students did what they must to get by, I was enthralled and absolutely loved being in the lab. Running various crosses and scoring flies became an obsession. I constantly looked forward to see which adults would emerge from their pupae and what kind of patterns I could decipher. My excitement from genetics continues on into a genomics course that I am currently enrolled in. I wanted to broaden my knowledge and learn more specifics about DNA sequencing. So far we have worked on finishing which involves searching through thousands of base pairs in order to find high quality read discrepant base pairs, discrepant positions in low quality read regions, as well as single nucleotide polymorphisms in *Drosophila biarmipes*. My experience so far within this area of study has evolved to be a much greater interest than I had ever expected and brings me much excitement to be able to participate in this type of research.

The type of research I plan to take part in alongside Dr. Jones involves narrowing down the location of a “bang sensitive” gene mutation in *Drosophila melanogaster*. This specific mutation causes the fruit flies to experience what is very similar to a seizure when exposed to an abrupt, vigorous shock. There is still a lot to learn about these “bang sensitive” mutations, but researchers believe it can one day benefit humans with a similar condition. Although many of the known “bang sensitive” genes have been mapped, *bas*, the first “bang sensitive” mutation, has yet to be pinpointed to an exact location. By carrying out multiple mapping crosses and utilizing various molecular genetic techniques I hope to assist in advancing this research forward and if time and utilities allow successfully map the *bas* mutation.

I expect my experience in the SOAR program to be very eye opening. Since freshman year I had been looking forward to one day participating in the program, but it wasn't until I took genetics that I knew what I wanted to specifically focus on. It will allow me to enhance my laboratory skills as well as learn new techniques that I have not done in previous courses. I believe this will greatly benefit my future as a premedicine student by

connecting what I am researching in the lab with what I hope to practice one day as a health professional. By submerging myself ten weeks out of the summer into a topic I appreciate will provide exceptional experience that without SOAR I would not have had the opportunity to take part in.

#### Part IV: Expense Proposal

Project title — Mapping a bang-sensitive gene in *Drosophila melanogaster*

Faculty Mentor — Christopher Jones, Associate Professor of Biological Sciences

Student Researcher — Kaitlin Raseley

It is impossible to know in advance how many additional stocks will be necessary for this project; it will depend on initial results and luck. Assuming a total of 20 stocks are needed (a not-unreasonable number for this sort of work), that will cost \$190.00.

Additional expenses (e.g. routinely-used laboratory supplies, fly food ingredients, additional reagents) will be covered by the Department of Biological Sciences.