

## DETAILS OF PROPOSAL

### **Goals and Objectives: Explain clearly the nature of the project and what you intend to learn from it.**

The nature of the research that I will be conducting with Dr. Dahlseid includes extension of previous research in his laboratory. Specifically, the RNA levels for several telomere-related and two kinetochore protein genes have been shown to be effected by a specialized RNA degradation pathway known as nonsense-mediated mRNA decay. In order to help determine whether the observed effects are direct, through RNA degradation (the primary interest of the laboratory), I will construct novel DNAs for each of these genes. The novel DNAs will include a control element from the *GALI* gene fused, separately, to each of the genes in question. This will permit control of each of the telomere-related and kinetochore protein genes by the sugar source used in the yeast culture medium; galactose can then be used to turn the synthetic genes on, and glucose can be used to turn the genes off. Developing the ability to control the genes of interest in this way will permit measurement of the RNA degradation rates for each of them through the method of decay from steady-state, though these experiments will be done at a later time (spring semester, as a continuation of my January term research). The measurement of degradation rates in yeast strains with and without nonsense-mediate decay will allow us to determine whether the RNAs are effected directly, or not.

My goal is to engage productively in this research by making useful new plasmid DNA molecules needed for experiments to study RNA degradation in the Dahlseid lab. I hope to grow as a scientist in my critical thinking and problem-solving skills, my laboratory autonomy, and my knowledge of basic yeast biology. I also hope to use this time doing research to better elucidate my future goals and desires in pursuing a career that is potentially research-based.

### **Feasibility: Discuss the feasibility of this project, i.e. can this be completed with the resources available and in the stated time frame of the term?**

The goals I have outlined above are such that they can be completed in a one-month time period where I work 40 hours a week. This is because my goals for this independent study involve simply growing as a scientist, which will certainly be accomplished by actively participating in and working in a lab. While four weeks is not a long time in the world of research, I believe that the structure my project and the help of Professor Dahlseid will allow me to produce useful results within the given time frame. My previous experience in biological research will save me time, given that I have learned many of the needed basic laboratory techniques, so I will be able to focus intensely on my specific project and scientific question. All laboratory equipment and materials will be already available in the Dahlseid Lab.

**Basic Background: List any courses you have taken which relate to this study and indicate the grade you received in each.**

<b>Dept &amp; Crse No.</b>	<b>Course Title</b>	<b>Grade</b>
CHE-255	Biochemistry	IP
BIO-201	Cellular and Molecular Biology	A
BIO-101	Principles of Biology	A

**List any experiences, readings, or research you have already done which would support this study:**

- 1) ASPET Fellowship at the University of Michigan (Summer 2016)
- 2) Biochemistry Group Project (Fall 2016)
- 3) Various Readings Published by my Research Advisor

**Explain how these courses and experiences provide the foundation for your study.**

- 1) This past summer, I participated in a research program in the pharmacology department of the University of Michigan, Ann Arbor. There, I worked in a laboratory, which focused on the study on a specific protein found most prominently in the central nervous system, peripheral nervous system, and heart. The focus of my project was to characterize, by immunohistochemistry and fluorescence confocal microscopy, a mouse knockout model of this protein. From this experience, I have gained much self-confidence in performing independent lab work as well as specific experimental knowledge such as protein gel electrophoresis procedures, DNA gel electrophoresis procedures, specimen sample preparation, light and confocal microscopy, microbial culture, and extensive DNA cloning. All of these specific techniques will be of use in the laboratory project that I am proposing.
- 2) The second half of the laboratory portion of the biochemistry course at Gustavus involves the development, proposal, and execution of an original group project using the skills and knowledge obtained during the first half of the semester. Through this experience, the most important skills I've gained are those involving experimental design and setup. Both of these are skills that will be useful in any research scenario involving wet-lab experiments.
- 3) Both of the biology core classes that I have taken at Gustavus have prepared me for research in the biological field by teaching me the fundamental principles of biology. These principles lay the technical foundation on top of which I hope to grow as a research scientist, who thinks critically and questions specifically.

**Procedures:**

**What steps will you follow in conducting this study?**

- 1) I will work to understand the relevant literature and material related to yeast genetics and plasmid DNA work being done in this laboratory.
- 2) I will work to learn the necessary laboratory techniques and procedures involved in the construction of plasmid DNA clones.
- 3) I will perform experiments and plasmid DNA cloning procedures in the effort to successfully construct the aforementioned plasmids.
- 4) I will work with my research advisor to understand, develop, and outline experiments to be completed with the finished plasmid DNA clones.

**How will you structure your time in order to accomplish these steps? (e.g., approximately how much time will be spent reading, writing, in lab, consulting, etc.) If off-campus, specify where these activities will take place.**

Experiments & wet lab time (accounted for by time log): 60%

Data analysis/compilation for a poster draft: 10%

Meetings with research advisor: 5%

Reading relevant literature (1-3 Comprehensive Reviews; 10-12 Primary Sources) and documentation through preparation of an annotated bibliography: 25%

**How frequently, in what way(s), and for what purpose(s) will you confer with your instructor during the study. Be as specific as possible.**

I will meet with my research advisor formally 2-3 times a week for 30-60 minutes. I will informally meet with my research advisor as questions arise daily either in person, by email, or by phone.

<b>Date/Time</b>	<b>Method</b>	<b>Purpose</b>
TUES/THURS (2:30pm)	In person	Discuss current status of research; address any unanswered questions; discuss next steps and future directions.
Unscheduled	Phone/email	Answer immediate questions/concerns.

**Materials and Resources: What materials, resources, and equipment will you use in order to complete the study? List books and articles, which you are likely to read.**

Literature:

- 1) Dahlseid *et al* (1998)
- 2) Dahlseid *et al* (2003)
- 3) Schneider and Tollervey (2013)
- 4) Kaplan *et al* (1997)
- 5) Duina *et al* (2014)
- 6) GENETICS: YeastBook (Nov. 2011)

Lab Equipment/Materials:

- 1) Thermocycler for Polymerase Chain Reaction (PCR)
- 2) Horizontal agarose gel electrophoresis apparatus
- 3) FujiImager Gel documentation system
- 4) NanoDrop spectrophotometer for DNA/RNA quantification
- 5) InFusion DNA cloning technology (New England Biolabs)
- 6) Shakig incubator, culture tube roller, and microbial culture reagents
- 7) Capillary blotting apparatus and GeneScreen Plus (RNA transfer membrane)Radioactively-labeled dNTPs and Riboscribe Probe Synthesis kit
- 8) Hybridization oven
- 9) Cyclone PhosphorImager scanner

**Assessment: What end products and other means of evaluation will you have at the conclusion of this study? (e.g., lab reports, research papers, annotated bibliographies, journals, tests, quizzes, evaluations from outside the college community, self-evaluation reports). The final grade for the study will be on a letter grade scale (e.g., ABCDF).**

Product	Due Date	Portion of Final Grade
Wet Lab Participation (160 hours over 4 weeks-time logs)	Jan. 27 <sup>th</sup> , 2017	65%
Annotated Bibliography	Jan. 27 <sup>th</sup> , 2017	25%
Poster Draft	Jan. 27 <sup>th</sup> , 2017	10%