BIOL 59000: DATA SCIENCE PROJECT FOR LIFE SCIENTISTS
PROPOSAL, PROSPECTUS AND ANNOTATED BIBLIOGRAPHY

The individual capstone research project must focus on a topic that applies data analytics in the context of bioinformatics or computational biology. This work must make a scholarly contribution to existing knowledge and practice in the field. Although the topic of each student's project will vary, all should draw upon concepts and skills learned in all other courses in the MSDS program, with focus potentially falling on one or two areas more than others. Projects may:

- Focus on analyzing a large-scare, real world data set
- Develop a software tool for Data Science related work (identifying a data set that could be used to test the functionality of this software)
- Implement machine learning or other data science-related techniques in real-time systems

PROPOSAL:

The proposal section of the assignment should be 3-5 pages in length and describe your intentions for your research project. This document should make clear your project topic, motivation for the project summarize related work already found in the literature, and give a methodology for implementing the project. As appropriate, in text citations should be given.

PROSPECTUS:

The research project detailed in the proposal section of the assignment should then be mapped out in the prospectus. This detailed outline will be the template for fully developing the written report in weeks to come, and essentially will serve as the table of contents for the final project. In this detailed outline, it is important to develop detailed subheadings, and indicate where major concepts will be discussed. It is good practice to utilize sub-headings only when two or more are necessary (do not create a "sub-heading 1" without a "sub-heading 2" section. Each project will need to include four major sections: introduction/background, methods, results, and discussion/conclusions (see the "Format Guide for Written Report" for details). However, depending on the particular project, it may be appropriate to subdivide the results portion into multiple chapters/sections. The following outline is merely an example; modify sections as necessary to best suit your project.

PROSPECTUS

I. INTRODUCTION (*Chapter 1*)

A. B Cell Development
B. Pre-B Cell Receptor Signaling
C. IL-7 Receptor Signaling
D. Cell Cycle
    1. D-type Cyclins
    2. Cell Cycle Components in B Cell Development
E. Objectives of Study

II. METHODS (*Chapter 2*)

A. Culture of Cells
B. Image Analysis
C. Retroviral Gene Transduction
D. Statistical Analysis

III. DIFFERENTIAL REGULATION OF D-TYPE CYCLINS (*Results – Chapter 3*)

A. Distribution of cyclin D2 and cyclin D3 in B cell progenitors
B. Distribution of cyclin D2 and cyclin D3 in embryonic fibroblasts

IV. PI3K SIGNALING AND PROLIFERATION IN B CELL PROGENITORS (*Results – Chapter 4*)

A. PI3K activation downstream of pre-BCR and IL-7R
B. Impact of PI3K inhibition on cell cycle status

V. CONCLUSIONS AND PERSPECTIVES (*Discussion/Conclusion – Chapter 5)*

A. Importance of signaling to control proliferation and differentiation in B cell progenitors
B. D-Type cyclins in the context of B cell development
    1. Cyclin D2 and cyclin D3 play functionally different roles
    2. Cyclin D3 important for cell cycle regulation as well as additional, cell cycle-independent functional role

ANNOTATED BIBLIOGRAPHY:

The annotated bibliography should report 10-15 resources that support your project. Although the majority of these resources should be primary research articles, you may also supplement with secondary review articles and other appropriate sources necessary for completion of your project. Because this project must demonstrate your proficiency as a data scientist, you must also indicate source(s) of data that will be used to complete this project. Complete reference information must be provided for each source, given in APA format. Each source should also be accompanied by a brief summary of the pertinent information provided by that source. For additional information about annotated bibliographies, please reference How to Prepare an Annotated Bibliography.