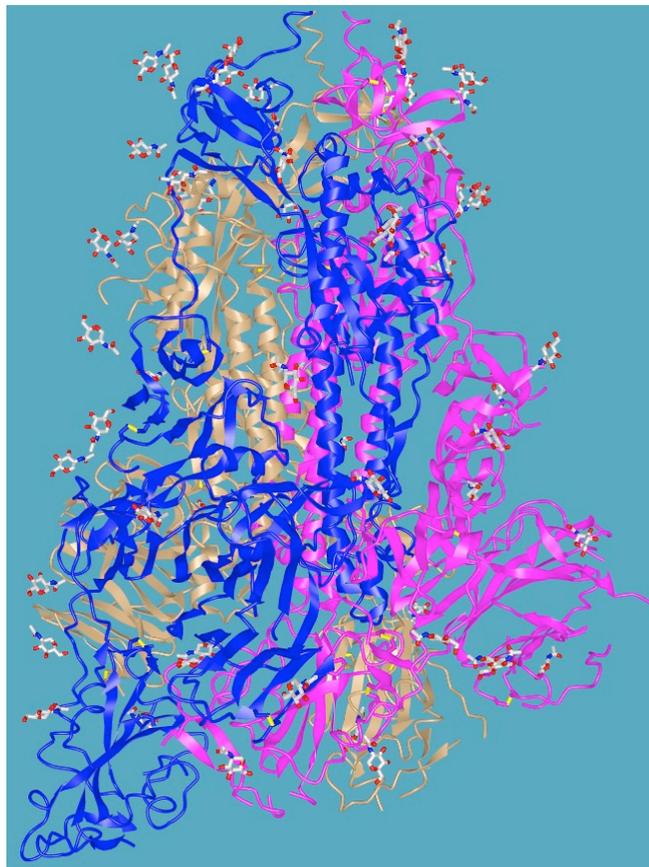




MEDICAL SCHOOL
BIOLOGICAL CHEMISTRY
UNIVERSITY OF MICHIGAN

BIOLOGICAL CHEMISTRY

MASTERS PROGRAM



STUDENT HANDBOOK

2020-2021

About the Cover

Structure of the SARS-CoV-2 Spike Glycoprotein (PDBID:6VYB)

The transmembrane spike glycoprotein of the SARS-CoV-2 coronavirus represents a critical component by which the virus is able to infect the epithelial cells of the lung to cause COVID-19. The structure of the spike protein was recently determined using cryoelectron microscopy by the Dr. David Veessler and colleagues at the University of Washington (1). The recombinant spike protein was also used to support the hypothesis that the human angiotensin I converting enzyme (ACE2) acts as a receptor the SARS-CoV-2 virus. Members of the Biological Chemistry Department have also been involved in critical studies of the SARS-CoV-2 virus. Dr. Janet Smith and colleagues from the Center for Structural Biology here at the University of Michigan have also produced recombinant SARS-CoV-2 spike protein to be used for the development of antibody tests (2). Also the laboratory of Dr. Yang Zhang has generated 3D structural models for all proteins encoded by the SARS-CoV2 genome (3).

1. Walls, A.C., Park, Y.J. Tortorici, M.A., Wall, A., McGuire, A.T., and Veessler, D. Structure, Function, and Antigenicity of the SARS-CoV-2 Spike Glycoprotein
2. <https://news.umich.edu/u-m-researchers-advance-antibody-test-production-to-aid-in-the-international-fight-against-covid-19/>
3. <https://zhanglab.ccmb.med.umich.edu/COVID-19/>



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MASTERS PROGRAM ADMINISTRATION

Master's Program Directors	Dr. Alex Ninfa	(734) 763-8065; aninfa@umich.edu
	Dr. Michael Uhler	(734) 647-3188; muhler@umich.edu
	Dr. Debra Thompson	(734) 936-9504; dathom@umich.edu
Graduate Programs Manager	Ms. Beth Goodwin	(734) 764-8594; egoodwin@umich.edu

PROGRAM OVERVIEW

The Department of Biological Chemistry offers one-year Masters Programs designed to broadly train tomorrow's leaders in biomedical sciences. Our graduates are well prepared for matriculation into elite graduate or medical programs as well as for employment in industry. Two tracks of study are offered, depending upon the goals and interests of the student.

Masters in Biochemistry-Research Track: This one-year program of didactic coursework in biochemistry includes an intensive research experience and a written research thesis. This program is intended for individuals seeking to increase their skills and research experience for employment opportunities, or for application to highly competitive Ph.D. or medical professional degree programs.

The intensive research experience is a key feature of the research-track. Our [faculty members](#) conduct research at the cutting edge of modern biochemistry and molecular biology. Current areas of research include structural biology, protein biochemistry, enzyme reaction mechanisms, molecular genetics, signal transduction, neurobiology, cell and developmental biology, and bioinformatics. Students match with faculty research advisors by mutual consent, either before arrival on campus or immediately thereafter. The capstone of the research experience is the thesis dissertation.

Masters in Biochemistry-Coursework Track: This two-semester program of didactic coursework in biochemistry and related fields is designed for students who plan to attend medical, dental, veterinary, law, or other professional programs. Students on this track take two semesters of rigorous, graduate-level, coursework. In addition, students will conduct a mentored literature review in a selected area of interest, working one-on-one with a research faculty, and culminating in a short but scholarly review article. Students on this track are exposed to an impressive array of modern research through seminar programs, a critical analysis course, and interactions with our faculty, and are well prepared to succeed in professional programs.

CURRICULUM

Coursework in both tracks consists of required and elective components. To maintain academic standing, advance to the second semester of the program, and to be awarded the M.S. degree, a B- or better is required in all coursework. Students experiencing difficulty in any course should contact the Master's Program Directors early in the term and tutors can be identified to assist the M.S. students.

Master's Graduate Curriculum - Research Track

A. Biological Chemistry Required Course:

BIOLCHEM 655* Molecules of Life: Protein Structure, Function & Dynamics (3 Cr, F)

For most students with advanced standing in biochemistry (e.g. biochemistry UG degree)

OR BIOLCHEM 515 Introductory Biochemistry (4 Cr, F, W)*

*With permission of MS Program Directors

B. Biological Chemistry Advanced Electives (2 Credits minimum):

Fall

BIOLCHEM 650 Eukaryotic Gene Transcription (2 Cr, F)

BIOLCHEM 690 Biochemical Regulatory Mechanisms (2 Cr, F)

Winter

BIOLCHEM 640 Regulatory RNA and Control of Gene Expression (2 Cr, W)

BIOLCHEM 528 Biology and Chemistry of Enzymes (2 Cr, W)

BIOLCHEM 673 Enzyme Kinetics (3 Cr, W)

BIOLCHEM 675 Biochemistry and Cell Biology of Membranes and Organelles (2 Cr, W)

BIOLCHEM 602 Protein Crystallography (3 Cr, W)

C. Additional required courses:

BIOLCHEM 597 Critical Analysis (3 Cr, W)

BIOLCHEM 712 Biological Chemistry Seminar Series (1 Cr F/ 1 Cr W)

BIOLCHEM 711 Graduate Seminar (1 Cr F/ 1 Cr W)

BIOLCHEM 600 Independent Research (6-8 Cr F/ 6-8 Cr W)

PIBS 503 Research Responsibility & Ethics (1 Cr, F)

D. Electives** (3 Cr minimum):

Fall

BIOINF 527 Introduction to Bioinformatics and Computational Biology (4 Cr, F)

BIOINF 528 Advanced Applications of Bioinformatics (3 Cr, F)

BIOPHYS 520 Biophysical Chemistry I (Methods and Techniques) (3 Cr, F)

BIOSTAT 501 Introduction to Biostatistics (4 Cr, F)

BIOSTAT 521 Applied Biostatistics (4 Cr, F) [calculus prerequisite]

CDB 530 Cell Biology (3 Cr, F)

CDB 581 Developmental Genetics (3 Cr, F)

HUMGEN 541 Molecular Genetics (3 Cr, F)

PHYSIOL 502 Human Physiology (4 Cr, F)

Winter

BIOINF 524/525 Foundations in Bioinformatics & Systems Biology (3 cr 524/525 3 modules, 1 Cr each, W)

BIOPHYS 521 Biophysical Chemistry II (Theories) (3 Cr, W)

CDB 550 Histology (4 Cr, W)

CDB 582 Stem cells: Organogenesis to Regenerative Biology (3 Cr, W)

CHEMBIO 502 Chemical Biology II (3 Cr, W)

MICRBIOL 504 Cellular Biotechnology (3 Cr, W)

PATH 581 Tissue, Cellular and Molecular Basis of Disease (3 Cr, W)

**This is a partial list. Consult your research mentor & academic advisor if you would like to take an elective course or courses not listed above. COVID-19 conditions may have significantly changed course formats to encourage social distancing.

E. Research:

Fall and Winter

BIOLCHEM 600 Independent Study (Master's thesis research) (5-6 Cr F/ 5-6 Cr W)

A typical credit load is 14-15 credits per term with a minimum of 29 credits, including 4 cognate credits, and development and completion of a written thesis.

Thesis and Thesis Advisory Committee – Research Track

Thesis research will be done in the Fall and Winter terms and culminate in the writing of a Master's Thesis. The thesis is expected to be a synthesis of scholarly background and discussion of the research project, in addition to an original experimental or theoretical contribution to the field. By the end of October, students are expected to form their Thesis Advisory Committee, composed of the research advisor and two additional Biological Chemistry faculty members. By the end of November, students are expected to meet with their Advisory Committee. The student should provide an overview of the research project, summarize progress to date, provide an outline of planned experiments and a timeline for completion of the dissertation. Monthly consultation with the Master's Program Directors is also expected. A second meeting of the thesis committee is required during the Winter term and it is expected that the research will be completed by the end of the academic year in most cases, with the written thesis submitted no later than the end of Spring/Summer term. The student's Advisory Committee will evaluate the submitted thesis. The Master's degree (MS) will not be awarded until all required revisions are completed and approved by the Thesis Advisory Committee, the Department, and the Rackham Graduate School.

Key Dates - Research Track

Throughout fall and winter terms, attend lab meetings and seminars/symposia recommended by your research mentor. Talk to your research mentor about work/research expectations.

- Oct 2 Apply for Rackham Research Grant
<https://rackham.umich.edu/funding/funding-types/rackham-graduate-student-research-grant-2/>
(List Anne Vojtek avojtek@umich.edu as Departmental Program Chair, and Beth Goodwin egoodwin@umich.edu as Graduate Coordinator on the online application)
- Oct 30 Form Thesis Committee and submit form to Beth at egoodwin@umich.edu
- Nov 25 Schedule your first committee meeting **prior** to Thanksgiving break.
- Send an abstract to your committee members by email at least two days prior to your scheduled meeting.
 - Prepare a powerpoint presentation for your committee meeting:
 - *Introduction of research topic*
 - *Outline your goals*
 - *Present hypothesis*
 - *Discuss experimental plans and data*
 - Provide a draft of your presentation to your research mentor *at least one week* prior to your committee meeting and meet with him or her to get input on the presentation.
- Dec 11 Departmental Poster Session* (*date to be confirmed*)
- Jan 29 Submit a draft of your thesis introduction to mentor; copy egoodwin@umich.edu
- Feb 26 Convene your second thesis committee meeting. Submit mtg progress form to egoodwin@umich.edu
- Apr 1 Submit experimental chapters to mentor; copy egoodwin@umich.edu
(For consideration of May degree)
- Apr 16 Research Track Symposium* (*date to be confirmed*)
- Apr 19 Final revised Research Thesis due to Program Directors and egoodwin@umich.edu

*Many of the events may be in a revised format due to COVID-19 social distancing restrictions.

Master's Graduate Curriculum - Course Track

A. Biological Chemistry Required Course:

BIOLCHEM 655* Molecules of Life: Protein Structure, Function & Dynamics (3 Cr, F)

For most students with advanced standing in biochemistry (e.g. biochemistry UG degree)

OR BIOLCHEM 515 Introductory Biochemistry (4 Cr, F, W)*

*With permission of MS Program Directors

B. Biological Chemistry Advanced Electives (2 credits minimum):

Fall

BIOLCHEM 650 Eukaryotic Gene Transcription (2 Cr, F)

BIOLCHEM 690 Biochemical Regulatory Mechanisms (2 Cr, F)

Winter

BIOLCHEM 640 Regulatory RNA and Control of Gene Expression (2 Cr, W)

BIOLCHEM 528 Biology and Chemistry of Enzymes (2 Cr, W)

BIOLCHEM 673 Enzyme Kinetics (3 Cr, W)

BIOLCHEM 675 Biochemistry and Cell Biology of Membranes and Organelles (2 Cr, W)

BIOLCHEM 602 Protein Crystallography (3 Cr, W)

C. Additional required courses:

BIOLCHEM 597 Critical Analysis (3 Cr, W)

BIOLCHEM 712 Biological Chemistry Seminar Series (1 Cr F/ 1 Cr W)

BIOLCHEM 711 Graduate Seminar (1 Cr F/ 1 Cr W)

BIOLCHEM 601 Tools for Scientific Research (4 Cr F)

BIOLCHEM 603 Independent Literature Research (4 Cr W)

PIBS 503 Research Responsibility & Ethics (1 Cr, F)

D. Electives** (3 Cr minimum):

Fall

BIOINF 527 Introduction to Bioinformatics and Computational Biology (4 Cr, F)

BIOINF 528 Advanced Applications of Bioinformatics (3 Cr, F)

BIOPHYS 520 Biophysical Chemistry I (Methods and Techniques) (3 Cr, F)

BIOSTAT 501 Introduction to Biostatistics (4 Cr, F)

BIOSTAT 521 Applied Biostatistics (4 Cr, F) [calculus prerequisite]

CDB 530 Cell Biology (3 Cr, F)

CDB 581 Developmental Genetics (3 Cr, F)

HUMGEN 541 Molecular Genetics (3 Cr, F)

PHYSIOL 502 Human Physiology (4 Cr, F)

Winter

BIOINF 524/525 Foundations in Bioinformatics & Systems Biology (3 Cr 524/525 3 modules, 1 Cr each, W)

BIOPHYS 521 Biophysical Chemistry II (Theories) (3 Cr, W)

CDB 550 Histology (4 Cr, W)

CDB 582 Stem cells: Organogenesis to Regenerative Biology (3 Cr, W)

CHEMBIO 502 Chemical Biology II (3 Cr, W)

MICRBIOL 504 Cellular Biotechnology (3 Cr, W)

PATH 581 Tissue, Cellular and Molecular Basis of Disease (3 Cr, W)

**This is a partial list. Consult your research mentor and academic advisor if you would like to take an elective course or courses not listed above. COVID-19 conditions may have significantly changed course formats to encourage social distancing.

Literature Analysis & Review Article - Course Track

Course track MS degree students will take an advanced literature analysis course (Biolchem 603), in which each student will focus on an important area of current research, review the research literature in that area in depth, and analyze this research thoroughly. Each student will produce a concise and impactful review of the subject, complete with thoughtful suggestions for future directions, suitable for publication. In the course of preparing the review, the student will become expert in the literature of the chosen area.

The preparation of these reviews will be supervised by the course track faculty mentor. Each student is expected to meet formally with their mentor each week, or more as deemed necessary, so that the mentor may guide the work, and additional contact by email will frequently occur for communication of draft versions, background papers, and notes. Monthly consultation with the Master's Program Directors is also expected. During the preparation of manuscripts, both the mentor and the student may need to consult with additional faculty members to obtain expert opinions.

A typical credit load is 14-15 credits per term with a minimum of 29 credits, including 4 cognate credits.

Key Dates – Course Track

Sep 15	Identify Mentor and send name to Beth at egoodwin@umich.edu
Sept 30	Student Mentor Agreement Form Due. Provide Beth with a copy at egoodwin@umich.edu
Dec 1	Outline of Paper Due – submit to your Mentor and copy the Program Directors dathom@umich.edu and muhler@umich.edu
Jan – Apr	Present your 711 Seminar
Jan 29	Submit draft of Introduction to your mentor (copy Beth at egoodwin@umich.edu)
Mar 30	Submit draft of entire paper to your mentor and the Program Directors dathom@umich.edu and muhler@umich.edu
Apr 9*	Course Track Symposium (<i>date to be confirmed</i>)
April 19	Submit Final Version of your paper to your mentor and the Program Directors; copy Beth dathom@umich.edu and muhler@umich.edu egoodwin@umich.edu

*Many of the events may be in a revised format due to COVID-19 social distancing restrictions.

RACKHAM AND BIOLOGICAL CHEMISTRY ACADEMIC POLICIES

Students in the program are expected to familiarize themselves with Rackham's Academic Policies including the Academic and Professional Integrity Policy (see <http://www.rackham.umich.edu/policies/gsh/>) and the "Compact of UM-Biochemistry Graduate Student Commitments" (see page 11).

ACADEMIC PERFORMANCE

The Rackham Graduate School requires students to maintain a grade point average of B (3.0 on a 4.0 scale) and additionally the Department of Biological Chemistry requires all students to receive grades no lower than a B- in all courses, required or elective. In order to maintain good academic standing, you must at minimum be making satisfactory progress towards your degree and maintain a GPA of 3.0 or higher. A student whose cumulative GPA falls below a B, who is not making satisfactory progress toward the degree, or who is failing to demonstrate an ability to succeed in his or her plan of studies, will be formally notified in writing and may be denied permission to register, required to withdraw, or dismissed from the program. The Biological Chemistry Graduate Program Committee will review the student's progress and make the final determination as to whether the student can continue in the program. Students must be in good academic standing to submit a written Master's thesis/paper for evaluation. Work with your course directors or instructors if you are having difficulties and ask if any remediation is possible. A student receiving lower than a B- in a required course may petition the Graduate Program Committee to repeat the course during the next term that the course is offered. A student receiving lower than a B- in an elective course may petition to take another elective course. A maximum of two courses can be petitioned for any Master's student. If a petition to repeat or substitute coursework is not approved by the Graduate Program Committee, the student will be dismissed from the Master's program.

BIOLOGICAL CHEMISTRY SEMINAR SERIES

The Department of Biological Chemistry sponsors a weekly seminar program during the Fall and Winter terms that attracts outside speakers of international reputation. The seminars are held each Tuesday at Noon and all biochemistry students are required to attend. Students are invited to share lunch and conversation with the speaker following the seminar. In addition to the weekly seminar program, the Department sponsors an annual Distinguished Alumni Lecture and five endowed lectureships: the Irwin Goldstein Lectureship in Glycobiology, the G. Robert Greenberg Lectureship in Biological Chemistry, the William E.M. Lands Lectureship in the Biochemical Basis for the Physiology of Essential Nutrients, and the Martha L. Ludwig Lectureship in Structural Biology, and the Rowena Matthews Lectureship in Biological Chemistry.

FALL POSTER SESSION

Research track students will present their research at a poster session held at the conclusion of the Fall term. Course track students will also present a poster as part of the BC 601 course near the end of the Fall term.

STUDENT CHALK TALKS

Students in the Department of Biological Chemistry meet approximately twice each month for lunch, conversation, and an informal research talk. This gathering provides an opportunity for students to keep in touch with their colleagues and to share scientific expertise and advise. The chalk talk schedule can be found on our website.

WORK HOURS AND VACATION GUIDELINES

Students should consult with their mentors regarding specific laboratory policies on research hours, vacations, and planned absences. Request for time off from research must be done in advance and in consultation with the student's mentor.

DEPARTMENT SOCIAL EVENTS

Annual Departmental Retreat

The student-organized Biological Chemistry retreat, held at the beginning of the Fall semester at Kellogg Biological Station on Gull Lake in Western Michigan, provides students, postdoctoral fellows and faculty an opportunity to present and discuss research in a relaxed and informal setting.

Monthly Happy Hour

Once a month, members of the department are invited to gather together to enjoy conversation and appetizers.

WEB RESOURCES

LABORATORY SAFETY AND TRAINING

OSEH – Occupational Safety and Environmental Health

<https://ehs.umich.edu>

WELCOME MATERIALS FOR NEW GRADUATE STUDENTS

<http://www.rackham.umich.edu/current-students/life-at-michigan/after-you-arrive-on-campus/welcome-materials>

RESOURCES FOR GRADUATE STUDENTS

<http://www.rackham.umich.edu/current-students>

WRITING SUPPORT

<http://www.lsa.umich.edu/sweetland/>

RACKHAM ACADEMIC POLICIES

<http://www.rackham.umich.edu/policies/gsh/>

INTEGRITY IN SCHOLARSHIP

<http://www.rackham.umich.edu/current-students/policies/academic-policies/section11>

PROFESSIONAL DEVELOPMENT

<http://www.rackham.umich.edu/current-students/graduate-student-success/pd>

<http://alumni.umich.edu/students/career-resources>

HOW TO GET THE MENTORING YOU WANT

<http://www.rackham.umich.edu/downloads/publications/mentoring.pdf>

PARENTAL ACCOMMODATION POLICY

<http://www.rackham.umich.edu/current-students/policies/parental-accommodation-policy>

HEALTH AND WELLNESS RESOURCES

<http://www.rackham.umich.edu/current-students/life-at-michigan/health-wellness>

FINANCIAL ASSISTANCE

Emergency Funds

<http://www.rackham.umich.edu/prospective-students/funding/student-application/graduate-student-emergency-funds>

Fellowships, grants and scholarships

<http://www.rackham.umich.edu/prospective-students/funding>

Rackham Student Research Grant

<http://www.rackham.umich.edu/prospective-students/funding/student-application/graduate-student-research-grant>

Rackham Conference Travel Grant

<http://www.rackham.umich.edu/prospective-students/funding/student-application/rackham-conference-travel-grant>

Mentoring Plan

UM-Biochemistry Graduate Student Commitments

- I acknowledge that I have the primary responsibility for the successful completion of my degree. I will be committed to my graduate education and will demonstrate this by my efforts in the classroom and the research laboratory. I will maintain a high level of professionalism, self-motivation, engagement, scientific curiosity, and ethical standards.
- I will meet regularly with my mentor and provide him/her with updates on the progress and results of my activities and/or experiments.
- I will work with my mentor to develop a thesis project or paper. This will include establishing a timeline for each phase of my work. I will strive to meet the established deadlines.
- I will be knowledgeable of the policies and requirements of my graduate program, Rackham Graduate School and the University of Michigan. I will commit to meeting these requirements.
- I will work together with my mentor and the program directors to fulfill all program requirements according to my graduate program guidelines. I will be responsive to the advice of and constructive criticisms from my mentor and directors.
- I will attend and participate in laboratory meetings, seminars and journal clubs that are part of my educational program.
- I will comply with all UMMS and Rackham Graduate School policies, including academic program milestones. I will comply with both the letter and the spirit of all institutional safe laboratory practices and animal use and human-research policies at my institution.
- I will participate in the UM Responsible Conduct of Research Training Program (PIBS 503) and practice those guidelines in conducting my research.
- I will be a good departmental and laboratory citizen. I will agree to take part in shared laboratory responsibilities and will use laboratory resources carefully and frugally. I will maintain a safe and a clean laboratory space. I will be respectful of, tolerant of, and work collegially with all departmental personnel.
- I will maintain a detailed, organized, and accurate research notebook. I am aware that my original notebooks and all tangible research data are property of my institution but that I am able to take a copy of my notebooks with me after I complete my thesis.
- I will discuss policies on work hours, sick leave and vacation with my mentor. I will consult with my mentor and notify fellow lab members in advance of any planned absences.
- I will discuss policies on authorship with my mentor. I will work with my mentor to submit all relevant results in a timely manner prior to my graduation.
- I acknowledge that it is primarily my responsibility to develop my career following the completion of my degree. I will seek guidance from my research advisor, dissertation committee, other mentors and any department resources available for advice on career plans.

Adapted from the Association of American Medical Colleges and UM-PIBS.

Advice from 2019-2020 Students

From Cameron Fornwald:

1. If you don't fully understand a topic, do not be afraid to seek out additional help.
2. If you get in the weeds, don't try to be a cowboy and handle it on your own, talk to advisors or course directors, they're there to help.
3. Start your long term projects early and work on them as you can, don't try to do it all a few days before deadlines.
4. It's a grueling curriculum, embrace the grind while you can. You'll look back and wish you spent that extra few hours doing additional research or studying.
5. Make as many connections with professors and other students as possible. Ultimately, it will only benefit you in the long run.

From Madeline Motsinger

1. Trust in yourself: This program flies by in an instance, and because it is only one year you are thrown into the deep end right off the bat. Trust in yourself and your abilities, Mike and Alex have confidence that you can handle the academic and research rigor you face, so do yourself the favor and believe in yourself too. It will not be immediate or easy, but with time you will slowly find the ground under your feet and start understanding more than the first 5 minutes of a seminar. It will take time and dedication to learning, but you will soon find confidence in discussing the expansive research.
2. Maximize your resources: There will be many challenging times, whether it be in your own research, the 711 presentation, or your classes, but the resources are there if you choose to seek them out to provide you the tools and support to succeed. This includes your professors' office hours or stopping into their labs to discuss and clarify class content or research techniques.
3. Connect: As I said the year flies by and in the end I promise (or really hope given our year's results were 10/10) that you will look back with joy and admiration for all that you accomplished. Keep an open mind, you never know when a new opportunity or professional relationship will arise. Create relationships with the PhD students, they'll provide unique and insightful perspectives and knowledge.
4. Thesis: Abide by Beth, Mike and Alex's tentative timeline! You will be so glad.
5. Reach out: I will be around and would love to grab coffee and chat about science or non-science related material at any point. Best of luck.