Computational Bioscience Program

SCHOOL OF MEDICINE

UNIVERSITY OF COLORADO **ANSCHUTZ MEDICAL CAMPUS**

2025-2026
Student Handbook

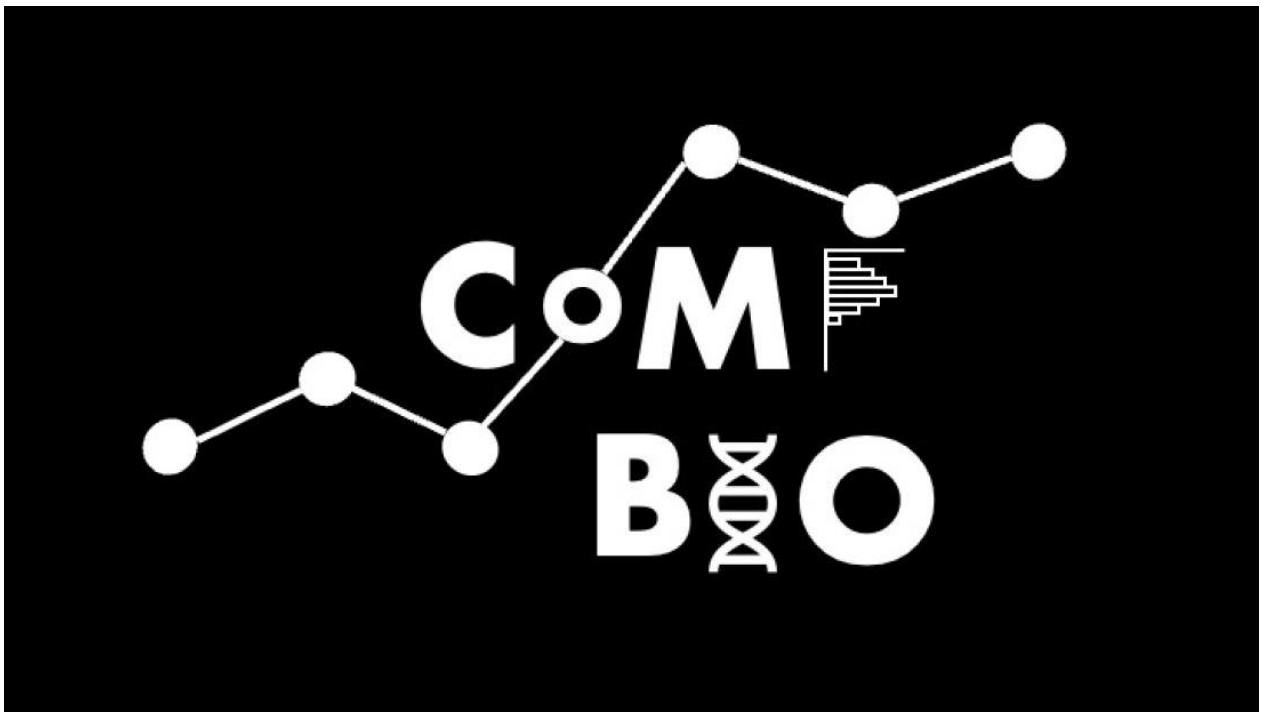

Image created by Brook Santangelo

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Computational Bioscience Program

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Program Overview

MISSION STATEMENT

The Computational Bioscience Program of the University of Colorado School of Medicine is dedicated to training computational biologists who aspire to achieve excellence in research, education and service, and who will apply the skills they learn toward improving human health and deepening our understanding of the living world. The Computational Bioscience Program provides graduates with the foundation for a lifetime of continual learning. Our curriculum integrates training in computation and biomedical sciences with student research and teaching activities that grow increasingly independent through the course of the program. Our graduates are able to do independent computational research, collaborate effectively with other scientists, and to communicate their knowledge clearly to both students and the broader scientific community. The Computational Bioscience Program is committed to continually reviewing and improving its curriculum as the science and practice of biomedical informatics evolves. The following four goals represent the foundation of the computational bioscience graduate education program at the University of Colorado.

EDUCATIONAL GOALS AND OBJECTIVES

Knowledge Goals

Graduates demonstrate their knowledge of core concepts and principles of computational bioscience, and the ability to apply computation to gain insight into significant biomedical problems. This knowledge includes mastery of the fundamentals of biomedicine, statistics and computer science, as well as proficiency in the integration of these fields. Graduates contribute to the discovery and dissemination of new knowledge.

Knowledge Objectives

1. Demonstrate knowledge of the scientific principles that underlie the current understanding of molecular biology, statistics and computer science.

2. Demonstrate an ability to productively integrate knowledge from disparate fields to solve problems in biomedicine using computational methods.

3. Demonstrate knowledge of the types and sources of data most commonly used in computational bioscience, including knowledge of all major public data repositories.

4. Demonstrate the knowledge of the classes of algorithms most often applied in computational bioscience, and their domains of applicability.

5. Demonstrate an understanding of the principles and practice of the scientific method as applied in computational bioscience, including experimental design, hypothesis testing, and evaluation of computational systems.

GRADUATE ADVISORY CHAIR (GAC)

During the first year, CPBS students will meet with the GAC monthly to discuss the students' progress in the Program and to address any issues that may arise. The CPBS graduate students will meet as a group with Program Director every semester to discuss issues relevant to the program. The students will be expected and encouraged to seek advice from the Program Director, GAC, and/or other Computational Bioscience faculty members prior to lab rotations, the Comprehensive Exam, and at other times when the student requires faculty consultation. Students are expected to choose rotation faculty from an approved list of faculty members provided by the program. If a student would like to rotate with faculty member who is not on the list of approved faculty (see **Appendix 8**), please contact the Program Director for approval. Useful information for rotations is included in **Appendix 9 and Appendix 10.**

ADVISING

General academic questions can be directed to the Program Administrator. Be sure to meet with them before completion of program milestones (Preliminary Exam, Comprehensive Exam, etc.) to ensure you are adhering to the graduate school rules. Once students have passed their Comprehensive Exam, they are admitted to candidacy for their Ph.D. At this point, students are required to meet with their full thesis committee at least once per year, though meetings twice per year are advisable.

We encourage all students to develop a diverse mentoring team. Mentors include at least your primary thesis mentor but can be much richer. Look to develop relationships with other faculty both inside and outside of the program. Mentors can also include more senior graduate students, postdocs, staff and people from outside the institution. Mentors can provide support and advice about more than just research; consider finding mentors regarding career development, specialized skills (e.g., entrepreneurship), or just someone whose judgment you value in planning your graduate education. There are no rules about how a mentoring relationship is structured, but regularly scheduled meetings (whether one a week, once a semester, etc.) are generally beneficial.

Communication Skills Goals

Graduates demonstrate interpersonal, oral and written skills that enable them to interact productively with scientists from both biomedical and computational domains, to clearly communicate the results of

their work in appropriate formats, and to teach others computational bioscience skills. Graduates are able to bridge the gap between biomedical and computational cultures.

Communication Skills Objectives

1. Communicate effectively, both orally and in writing, in an appropriate range of scientific formats, including formal presentations, collaborative interactions, and the critique of others' work.
2. Demonstrate familiarity with both biomedical and computational modes of expression and be able to communicate clearly across disciplinary boundaries.
3. Demonstrate commitment and skill in teaching and learning from students, colleagues, and other members of the scientific community.

Professional Behavior Goals

Graduates demonstrate the highest standards of professional integrity and exemplary behavior, as reflected by a commitment to the ethical conduct of research, continuous professional development, and thoughtfulness regarding the broader implications of their work.

Professional Behavior Objectives

1. Act in an ethically responsible manner, displaying integrity, honesty, and appropriate conduct at all times.
2. Recognize the limits of one's knowledge, skills, and behavior through self-reflection and seek to overcome those limits.
3. Always consider the broad significance of one's professional actions, including their implications for society and the living world.

Self-Directed and Life Long Learning Skills

Graduates demonstrate habits and skills for self-directed and life-long learning and recognize that computational bioscience is a rapidly evolving discipline. Our focus is on the development of adaptive, flexible and curious scientists who comfortably assimilate new ideas and technologies during the course of their professional development.

Self-Directed and Life Long Learning Skills Objectives

1. Recognize the need to engage in lifelong learning to stay abreast of new technologies and scientific advances in multiple disciplines.
2. Locate, evaluate and assimilate relevant new knowledge and techniques from a wide variety of sources.

Office of Research Education Contacts

Professor and Program Director: **Katerina Kechris, PhD**

- Phone: 303-724-4363
- Email: Katerina.kechris@cuanschutz.edu

ORE Program Administrator: Evelin Zumba

- Email: Evelin.zumba@cuanschutz.edu

Office of Research Education (located in the Fitzsimons Building, 5th Floor West, Suite W5107)

Angie Ribera: Associate Dean of Research Education, angie.ribera@cuanschutz.edu
- Point of contact for faculty, program, and organizational concerns and planning

Jodi Cropper: Business Services Program Director, jodi.cropper@cuanschutz.edu
- Point of contact for financial and organizational planning concerns and coordination
- Point of contact for student and related concerns

Morgan Texeira: Program Manager, morgan.texeira@cuanschutz.edu
- Point of contact for program specific concerns and additional point of contact for Program Administrators

Stephen Frazier: Business Service Professional, stephen.frazier@cuanschutz.edu
- Point of contact for ORE administrative concerns, organizational planning and ORE leadership availability

BSP & MSTP Requirements

Students transferring to the Computational Bioscience PhD Program from the Biomedical Sciences (BSP) or Medical Scientist Training (MSTP) programs may have different credit/course requirements (see Appendix 1). Applications for transfer will be evaluated based on thesis lab availability, transcripts, and performance on the preliminary exam and in rotation labs. It is important to understand that transfer from either program into the Computational Bioscience PhD Program depends on a Computational Bioscience PhD Program faculty member agreeing to accept the student into her/his lab for their thesis work.

MSTP Students should enter a thesis lab with 27-33 graduate credits, including graduate core. They have also completed/will complete the MSTP Preliminary Course focused on grant writing in Spring term of their transfer year. This course covers F31 grants, but also F30 grants which are specific to dual-degree trainees. The MSTP administration will review student transcripts with the PhD Program Administrator at time of transfer and will confirm that all expected graduate credits have posted for program review and evaluation.

MSTP students have already selected and been accepted into a thesis lab within the selected PhD program. They will enter the program under this lab's support immediately upon transfer and should not incur charges to the PhD program at any point in training absent the need for gap funding/support. As such please consider this transfer to be equivalent to a second year PhD student. Time to degree is a very

important metric for the NIH and the program's T15 grant. MSTPs are expected to complete their PhD training within four years of entering lab. Of course, mitigating circumstances can occur. The MSTP Administration should be alerted to any significant progress concerns which may impact a student's ability to graduate within the expected time frame. This can be accomplished by meeting, email, or committee meeting notes as appropriate.

- MSTP students should contact MSTP Administration to obtain the program specific lab mentor agreement to review lab mentor responsibilities, curriculum requirements and other expectations related to the research portion of training. **MSTP students must have thesis committee meetings every 6 months** regardless of their PhD program. Each MSTP student's thesis committee should have a faculty member representing MSTP. Students should discuss MSTP faculty representation with the Director or Associate Program Director to identify suitable candidates.
- Throughout the Thesis stage of training, MSTPs are required to register for the *Longitudinal Foundations of Doctoring* (FOD) course in 2 terms annually (Fall and Spring). They will enroll into the *Capstone Return-to-Clinics* course in their last year of thesis training, replacing FOD in the spring term. The MSTP mentor is responsible for covering the costs for these courses and agrees to this as part of the MSTP-specific mentor letter.

Curriculum Overview

Registration Process

- **Academic Calendars** (see The Graduate School calendar)
- **Register for Classes** (see The Graduate School)
    - All basic science PhD students must register in a minimum of 5 credits (fall and spring semesters), 1 credit of 8990 (summer semester), and anything above the minimum credit level will need approval from faculty mentor.
    - First year students, BSP and MSTP students should work with their Program director, Program Administrator, and faculty mentors as there will be additional credit requirements associated with their progress in the program.
    - The paying of tuition, fees and student health insurance occurs the week following the deadline for semester add/drop period, which can be found on the academic calendar . The Program Administrator will complete the process of submitting the appropriate form to the Bursar's Office. For those students receiving financial aid, please work with the Program Administrator to avoid any disruption in aid awarding.

Year 1

Fall Semester		
Course Title	**Registration Information**	**Credits**
Foundations in Biomedical Science	BMSC 7806	6
Core Topics in Computing Skills in the Biomedical Sciences – A	CPBS 7601	2
Core Topics in Introduction to Big Data in the Biomedical Sciences– B	CPBS 7602	2
Rotation 1 – (required~Sep,-Dec.)	CPBS 7650 (001)	1
Program Seminar	Attendance Required	0
		11
First year students will register for two sections, one section in Core Topics A (CPBS 7601) and one section in Core Topics B (CPBS 7602). Each section is a 3-week intensive special topics course; the Core Topic A sections start immediately after BMSC 7806 followed by Core Topic B sections.		
Spring Semester		
Course Title	**Registration Information**	**Credits**
Research Methods in Biomedical Informatics	CPBS 7712	4
Rotation 2 (required~Jan.-Mar)	CPBS 7650 (002)	1
Rotation 3 (required~Mar-May)	CPBS 7650 (0V3)	1
		6
Preliminary Exam (June) Choose mentor (by mid-June)		
Summer Semester		
Course Title	**Registration Information**	**Credits**
Doctoral Thesis	CPBS 8990	1
Research (Pre-Comps) if instructed to register for 4th rotation	CPBS 7650	3

***MSTP** students in the CPBS program must take CPBS Core courses A & B in their second year Fall and CPBS 7712 in the Spring term of joining the CPBS program.

- **Rotations**
  - **Laboratory Rotations**. Students must perform three rotations before the start of their second year. Rotations enable the student to explore and compare several areas of computational bioscience research and aid in the choice of a mentor and project for thesis work. Rotations also allow program faculty to evaluate the motivation, technical skills, and intellectual preparedness of students to undertake independent research. Please see Appendix 9 for Rotation resources.
  - **Rotation Selection:** Students start their first rotation in the fall semester, spending three months in each of three laboratories. We encourage you to set up your first rotation prior to arriving on campus. Please reach out to the GAC or Dr. Kechris (Program Director) regarding selection of rotation mentors. Your peer mentor and current students are an excellent source of advice as well. We strongly recommend that you wait until you are on campus before you set up your second and third rotations. We have program events at the beginning of the academic year that are designed specifically to highlight the wide variety of research opportunities available in computational bioscience. **Students are expected to select mentors from an approved list of rotation mentors within the computational bioscience program for all three of their rotations (see Appendix 8).** Potential faculty mentors should be contacted several weeks or more before the start of the rotation. MSTP students do two rotations in total, during the summers of the first and second year of Medical School.
  - **ORE Milestone Rotation** Request form to be used when first year students have identified their rotation mentor. Please follow Program specific guidelines, including the submission deadline. Three forms will be submitted throughout the academic year.
  - **Rotation Expectations:** For professionals in training, it is not appropriate to require a minimum number of hours for rotation work. Strong self-motivation is an absolute essential characteristic for an independent scientist, and we expect our students to demonstrate this quality throughout their training. In this regard, students should expect to frequently be in the lab beyond the normal working hours, i.e. at evening, on weekends, and possibly over vacation days during the term. In order to maximize the success of your rotation, we recommend setting up regular meetings with your faculty rotation mentor, drafting the specific aims and hypothesis with your mentor, and presenting your aims, hypothesis, and data in lab meetings throughout your rotation. An Aims page that is approved by the mentor must be submitted to the program within 2 weeks of the start of each rotation. A major part of the mentor's rotational assessment (as well as their willingness to accept a student) will be based on the degree and quality of lab effort. At the same time, it is critical for students to keep up with their coursework and to pass exam. Students should always discuss time off and/or vacation days with their lab mentor in advance, both in their lab rotations and once they enter a thesis lab. A short-written evaluation of the student's rotation will be provided by the rotation mentor (see **Appendix 9**). We strongly encourage students to meet with their rotation mentor to discuss their evaluation. Rotation grades are assigned by the rotation mentor following the rotation seminar.

- If you need a **Fourth Rotation,** you must request approval from your Program Director. The Program Administrator and Program Director will work with the Office of Research Education accordingly.
- **Rotation Seminar:** At the end of the rotation the student will present a post-rotation seminar. This seminar is an essential component of the research rotation and should be prepared with the help of the research mentor. Rotation seminars are 10-15 minutes in length with up to 3 additional minutes for questions. See Appendix 9 for the rotation talk evaluation form.

- **Research Update Talks**- Seminar Series
  - Required to attend in-person seminars
  - Wednesday's, 1:00pm – 2:00pm

- **Preliminary Exam**
  - Preparation for the preliminary exam during the spring courses. The exam is administered in early to mid-June (date determined on year-by-year basis). Refer to Appendix 2.
  - If you are a BSP student and have selected to join CPBS Program, you will take your prelim exam with the CPBS cohort.
  - The University of Colorado Graduate School requires two exams for students, a Preliminary Exam and a Comprehensive Exam. Computational Bioscience students, like most basic science graduate students, take a Preliminary Exam in June at the end of their first-year coursework. Continuation in the program is dependent on the student achieving a passing score. The format of this exam will be determined by the preliminary committee and may be changed at any time on the recommendation of the preliminary committee. The exam is not designed to test rote memory but instead to determine whether students can integrate their knowledge so that they can formulate scientific questions and understand how to test them. The goal of the preliminary exam is to catch deficiencies and provide a holistic evaluation of each student. Then, deficiencies can be addressed by the mentor/mentee pair prior to the Comprehensive Exam. The decision of the Preliminary Committee will be final. Please see **Appendix 2** for the exam rubric.
  - MSTP students' preliminary exams are equivalent to CPBS preliminary exams. Results must be reviewed with Program Director and Program Administrator.

- **Transferring Thesis Lab**
  - **Predoc Financial Support Agreement** for those faculty mentors who choose to take on a new predoctoral mentee.
- **Residency**
  - Per University policy, it is required that students begin the process of establishing their residency as soon as they accept their offer to join the PhD program. This process must

be started promptly to ensure you meet the necessary deadlines by the end of your first year. For more information, please visit the University website – **Residency**

Year 2

- Minimum registration requirement for full-time graduate students is 5 credits. Anything above 5 credits must be approved by faculty mentor.

Fall Semester		
Course Title	**Registration Information**	**Credits**
***Statistics and Data Analyses for the Biomedical Sciences	BMSC 7820	3
Research (Pre-Comps)	CPBS 7650 (sec 0V3)	1-5 (variable)
****Electives (as desired)	Must be approved by PD & Mentor	variable
Ethics in Informatics	CPBS 7605	1
Research Seminar Update talks	Attendance Required	0
All students (including MSTP) are required to take a biostatics course. Other biostatistics courses may fulfill this requirement upon approval of the Program Directors. * Number of elective credits needed depends upon educational background (Comp Sci, Bio, Math, etc) and number of graduate credits transferred into the CPBS program from other graduate programs. **** Students are required to take a minimum of **30 semester hours** of coursework before admission to candidacy. After these required courses and rotations, that leaves a minimum of **nine** remaining course credits (**usually three courses**) for electives during the second (or third) year. There are a wide variety of informatics and bioscience courses and programs at the University of Colorado campuses and our students have been very creative at taking advantage of them to pursue specific biomedical and informatics interests. **See Appendix 3** of the Handbook for more details on electives. MSTP students have typically met the elective requirement upon entering the program, which should be verified with the Program Director. *****BSP and MSTP students who did not take Responsible Conduct of Research (BMSC 7811) will take this course in the fall of their 2nd year.		
Spring Semester		
Course Title	**Registration Information**	**Credits**
Research (Pre-Comps)	CPBS 7650 (sec 0V3)	1-5 (variable)
Electives (as desired)	Must be approved by PD & Mentor	variable
Research Seminar Update talks	Attendance Required	0
Summer Semester		
Course Title	**Registration Information**	**Credits**
Doctoral Thesis	CPBS 8990	1

Comprehensive Exam/Thesis Proposal

Important: A student must **complete or be registered for in the semester of their Comprehensive Exam, 30 Didactic credit hours** (not including CPBS 8990 hours) before taking the exam. Any student passing 30 credits of course work that has *not* taken their Comprehensive Exam must continue to register for CPBS 7650-0V3 until the exam is taken; or the student may appeal to the Program Director and Program Advisor for permission to start registering for CPBS 8990.

Here is what counts (must be taken for a grade; and **receive B or above**) for Didactic credits:

- Core (6 credits)
- Core Topics A and B (4 credits)
- CPBS 7712 (4 credits)
- Rotations (CPBS 7650 – 1 credit per rotation; 3 credits)
- Biostatistics requirement (3 credits)
- Ethics requirement (1 credit)
- Approved electives (5000 or above; typically, 9 credits)
- CPBS 7650 research credits taken until comps (variable credits)

Notes: You don't have to take all of the elective courses above, but they are approved for the 30 Didactic credits. For the semester you are taking Comps, you can be enrolled in some of these credits to get to the 30 Didactic credits.

Following the completion of the required coursework and Comprehensive Exam, students will register for the appropriate credit hours of CPBS 8990 to maintain full-time status until the thesis defense. (Note: another 30 credit hours of Doctoral Thesis (CPBS 8990) are required **before** defending, so switching as soon as the requirements are completed is prudent).

- **Student Research Update Talks** – Seminar Series
  - Required to attend in-person seminars
  - Wednesday's, 1:00pm – 2:00pm
- **Comprehensive Exam**

  Students may take their Comprehensive Exam as early as the summer semester in Year 2, but must take the exam by the end of Year 3. See section (E.) Comprehensive Exam, and Appendix 4 for details regarding the exam format and preparation. A meeting with the Program Administrator will be held in the summer/fall of the 2nd year to review the policy and procedures surrounding the Comprehensive Exam.
  - **Required forms** to be completed using DocuSign
    - Application for Candidacy form
    - Exam Request form
    - Once a date has been set with your Thesis Advisory Committee, you must contact your Program Administrator to initiate forms. You will also discuss room bookings at this time. All forms must be submitted to the Administrator at least a month prior to the exam date.
- **MSTP Specific:** Please work with MSTP Administration and PhD Program Administration to complete the required mentorship agreement for transitioning into a lab.

Year 3 and beyond

- Minimum registration requirement for full-time graduate students is 5 credits. Anything above 5 credits must be approved by faculty mentor.
- Students defending in the current semester must register for 5 credits of CPBS 8990. If a student is defending between semester dates as defined by the Academic Calendar, the student must register for 5 credits of (Program) 8990, in the proceeding semester of the scheduled defense date.

Fall Semester		
Course Title	**Registration Information**	**Credits**
Research	CPBS 7650 (0V3) or CPBS 8990 if post-comps	1-5 (variable)
Electives (if applicable)	Must be approved by PD & Mentor	Variable
Research Seminar Update talks	Attendance Required	0
Thesis Advisory Committee meeting (TAC) and thesis update talk –minimumof1peryear; ideally2meetings per year each at ~ 6 month intervals		
Spring Semester		
Course Title	**Registration Information**	**Credits**
Doctoral Thesis	CPBS 8990	1-5 (variable)
Electives (if applicable)	Must be approved by PD & Mentor	Variable
Summer Semester		
Course Title	**Registration Information**	**Credits**
Doctoral Thesis	CPBS 8990	1 credit; 5 credits if you are defending in the summer

Ethics Refresher Course: An eight-hour refresher course is required for all students every 4 years. This means all our **5th year students** will take BMSC 7811 to fulfil this requirement. Registration is not required but you will need to contact the Program Administrator for more information on sitting in on the course.

- **Research Update Talks** – Seminar Series
  - Required to attend in-person seminars
  - Wednesday's, 1:00pm – 2:00pm
- **Thesis Committee meetings**
  - CPBS students are required to organized and prepare for their annual thesis committee meetings; ideally 2 meetings per year at ~6 month intervals.

Examinations and Evaluations

Preliminary Exam

- Every first-year student takes the Preliminary Qualifying Exam at the end of the first year of graduate school. BSP students that plan to join **CPBS** will participate in the program's preliminary exam.
- MSTP trainees transferring into **CPBS** current preliminary exams are accepted as an equivalent to the program preliminary exam. MSTP trainees will complete an MSTP specific preliminary exam prior to program transfer. (**See Appendix 1**).
- **Transfer to Thesis Lab.** An important aim of the rotations is to enable the student to find a thesis mentor. Within one month of the completion of the three rotations for regular graduate students or two rotations for MSTPs, the student should come to a mutual agreement with a faculty member to act as thesis mentor. The Program Director must formally approve the choice of a thesis mentor. Under some circumstances a co-mentor may be required by the Program. Co-mentors must be full training faculty in the Program. The co-mentoring plan must be approved by the Program Director (a template is available from the Program Director). **Official transfer to the thesis lab takes place on July 1.** Under exceptional circumstances and at the discretion of the Program Director, a student may be allowed to perform an additional rotation for the express purpose of enhancing the mentor selection process. Although the Program will assist the mentor selection process, it is ultimately the student's obligation to identify a thesis lab by the beginning of the second academic year. Failure to identify a suitable lab by this time will result in dismissal from the Program. Upon entering a thesis lab, it is highly recommended that the mentee and mentor develop a compact as a framework or developing a positive mentoring relationship. Please see **Appendix 11** for an example of Mentor and Mentee mutual expectations and a Mentor-Mentee compact from the AAMC.

Comprehensive Exam

- **Comprehensive committee formation** (**See Appendix 4 and Appendix 5**)
  - Successful completion of the Comprehensive Exam admits the students to Candidacy for the Ph.D. degree in Computational Bioscience. This exam can be taken as early as the spring semester of the second year, but is usually taken in the fall semester of the third year. The exam must be completed by the end of the fall semester of the students third year. It is highly recommended that the student carefully read the Graduate Student Handbook on Comprehensive Exam policies and deadlines and complete the required forms from the Graduate School (Request for Exam and Application for Admission to Candidacy) well ahead of the planned exam.
- **App Candidacy form**
- **Exam request form**
  - Once a date has been set with your Advisory Committee, you must contact your Program Administrator to initiate forms. You will also discuss room bookings at this time. All forms must be submitted to the Administrator at least a month prior to the exam date.
- As you prepare for your Comprehensive Exam, please ensure that all your committee members have a faculty appointment listed in the **Graduate School Faculty Directory.**

- All forms are found in the Graduate School website under the "Forms" section.
  - Graduate School - Resources & Forms - CU Anschutz
- AI Policies for Comprehensive Exam (**See Appendix 6)**

Thesis Defense

- **Thesis committee formation** (**See Appendix 7**)
  - By February 1 of their 3rd year, students must establish a Thesis Advisory Committee (TAC) and communicate this to the Program Administrator and Program Director. The specific composition of the committee should be determined in consultation with their thesis mentor and approved by the Program Director. In most cases this committee will be identical or similar to the Comprehensive Exam Committee. The purpose of the committee is to guide and evaluate the progress of the student during their thesis research. It cannot be emphasized enough, however, that each student is ultimately responsible for their own progress. The committee of 5 should be composed of majority of CPBS faculty members and least one faculty member from outside the program. A committee of three CPBS faculty and two outside members is allowed with the approval of the Program Director. The thesis mentor is not a voting member of this committee. The Chair of the thesis committee must be a senior member of the Computational Bioscience Program and not your mentor; he/she serves as the advisor to the student and monitors their progress. Any changes to the thesis committee must be discussed and approved by the committee chair and the Program Director. Students are required to meet with their committee at least once each year; however, it is HIGHLY recommended that the committee meet every 6 months and more frequently in the year prior to the thesis defense.
  - Final defense of the thesis/dissertation must be completed by Graduate School deadlines.
- **Thesis Research:** Students will generate an original body of research that constitutes a significant contribution to the field of computational bioscience. The student and faculty member together plan a thesis project; however, the thesis research is the responsibility of the student, who must be able to conceive, carry out and write up (a thesis) a significant body of work in a logical manner. Doctoral level work requires a close collaboration with a faculty mentor; it is the responsibility of the student to establish and maintain that relationship. Program faculty are always available for consultation and advice; however, it is the responsibility of the student to seek them out. It is worth repeating that strong self-motivation is an absolutely essential characteristic for a successful scientist. Students should expect to frequently be in the lab beyond the normal working hours, i.e. evenings, weekends, and possibly over vacation days during the term. Students should always discuss time off and/or vacation days with their lab mentor in advance, both in their lab rotations and once they enter a thesis lab. Note: All code and results from rotational and thesis work are the property of the mentor and a copy must be left with the mentor at the completion of the work.
- **Update Talks:** Students will give an annual report on the progress of their thesis research to the Computational Bioscience Faculty and Students in the form of a 30-minute seminar during their 2nd year. In their 3rd year and beyond students are expected to have 30-45 min talk and time for questions. After completion of the Comprehensive Exam students are required to give a thesis update seminar on an annual basis; Thesis Advisory Committee (TAC) meetings are required annually as well. Update seminars provide a good opportunity for the student's TAC to review the

student's progress and to invite input from the faculty as a whole, as well as afford the student opportunities to polish presentation skills. It is the responsibility of the Committee Chair to post a brief critique of the yearly seminar and update meeting on the Predoc Progress Assessment web site - **http://predocprogress.ucdenver.edu/** . Students actively writing their thesis may be exempt at the discretion of the Program Director.

- **Publication Requirement:** Publications are the culmination of the research done in the lab. It is the obligation of all scientists to share their findings with their peers and the public. **The program highly encourages students to have submitted articles based on their doctoral research before they exit the program with their doctoral degree. The student's manuscript should be the focus of their thesis work. The decision to let the student defend is at the discretion of the thesis committee and student's mentor.**
- **Biosketch Form**
  - This is a graduate school form, not the NIH form
- **Exam Request**
- **Thesis Approval form**
- Refer to Program Specific Guidelines in **Appendix 7**
- **Thesis and Dissertation Guidelines**
- ProQuest **General Information for Submitting Dissertation & Thesis** page 13 on Graduate School website
- **Watch** how to prepare the correct forms and upload your dissertation.
- AI Policies Guidelines for writing the Thesis. (**See Appendix 6**)
- If defending after the semester ends you must register for 5 credits of 8990 in the proceeding semester. (Thesis defenses must be tied to the end of the semester deadlines dates please see the links below)

  You can find all forms for the Comprehensive Exam and thesis defense on the Graduate School website under the "Forms" section.

- **Graduate School - Resources & Forms - CU Anschutz**

Thesis Defense Resources and Dissertation Guidelines

- **Thesis & Dissertation/ProQuest Format & Guidelines**
- **Graduate School Deadlines, Forms, Policies**
- See **Appendix 7 f**or program specific guidelines

Policies and Procedures

CPBS Program Specific Obligations and Expectations

- **Program Transfer**
  - For students matriculating directly into Basic Science Programs, there is an expectation that you will remain in that Program. You have matriculated into that Program by virtue of having applied and being accepted. Thus, there is a substantial bilateral commitment. Transferring

from a Program, at any point, is actively discouraged. If there are issues with an individual mentor or a perceived lack of research laboratory options, it is expected that solutions will first be explored within the Program. Program transfer will only be approved under exceptional circumstances, and then only after successful completion of the preliminary exam at the end of the first year.

- **Attendance**
  - All graduate students are required to attend post-rotational seminars and Thesis Defense Seminars of the other students in the program. All students are also required to attend the Computational Bioscience Program Seminar series and annual retreat.
- **Education Assistant Experience**
  - All students are expected to have 1 teaching/mentoring experience as an education assistant for the Core Topics, CPBS 7712, summer program (when offered), or other opportunities per Program Director's approval. This is considered a training experience to help develop teaching, organizational, and leadership skills in addition to building a well-rounded CV and solidifying your knowledge. This experience is an important component of your training and also builds community by providing service to the program by mentoring more junior students.
- **Student's File**
  - A file for each student will be kept by the Program Administrator. All relevant records should be given or emailed to the Program Administrator for the files, including published abstracts and papers, notifications of awards and honors, and copies of forms filed with the Graduate School. These files should reflect the total record of the student during their entire graduate career. The records can be examined by the student at any time.
- **Funding Proposals**
  - Students who have passed their Comprehensive Exam should submit a project proposal to seek funding for themselves at least once during their PhD studies (e.g., NIH F31, NSF GRFP). Please speak to your thesis mentor to determine which sponsor would be most appropriate for your project.
- **Publications**
  - The program highly encourages students to have submitted articles based on their doctoral research before they exit the program with their doctoral degree.
- **Participation in Recruitment Functions**
  - During January/February/March each year, prospective student applicants visit our program for interviews. It is in the Program's best interest to attract and retain the best of these prospective students. To do this we need the help of current students and Computational Bioscience faculty who can convince these individuals that our Program is the best for pursuing a Ph.D. in computational bioscience. When asked, please be willing to spend some time with prospective students during dinners or other functions. Our Computational Bioscience Program can only flourish with your help.
- **Vacation and Holidays**
  - Graduate students shall receive all CU Anschutz campus holidays and may receive an additional 10 weekdays (excluding weekends) of vacation per academic year, with no year-to-year accrual. Graduate students shall continue to receive stipends during vacations and holidays. Graduate students taking courses are expected to attend all classes and take all

exams as scheduled. The times between academic terms and the summers are all considered active parts of the training period and leave must be taken in accordance with this policy. Graduate students supported via extramurally funded projects or training grants must comply with sponsor requirements regarding effort.

- **Sick Leave and Other Leave**
  - Graduate students may continue to receive stipends for 11 weekdays (excluding weekends and campus holidays) of sick leave per academic year, with no year-to-year accrual. Under exceptional circumstances, additional sick days may be granted following a written request from the student and approval by the student's thesis advisor (if determined) and graduate program director. Sick leave may be used for medical needs related to pregnancy and childbirth. Absences needed to address chronic health conditions and/or disabilities as part of an Office of Disability, Access, and Inclusion (ODAI) formal accommodation plan may be treated separately from sick leave. Graduate students supported via extramurally funded projects or training grants must comply with sponsor requirements regarding effort. The full list of the Graduate School Policy for PhD Student Vacation and Leave can be found in the Graduate School Resources page here: **Graduate School - Resources & Forms - CU Anschutz.**

Students are required to keep a record of their leave through their home division or department.

- Procedure for leave reporting using the Graduate School time and leave reporting by logging at **https://gs.cuanschutz.edu/predocleave** and submit leave requests which will be routed to your mentor for approval.
- Use of AI (**See Appendix 6**)
- Communication
  - All PhD students are required to read emails from the Computational Bioscience Leadership and respond by the stated deadlines (or within two business days).
- Milestone updates and changes
- **ORE Honor Code Policy and Committee Procedures**
  - This Office of Research Education (ORE) Honor Code policy provides specific guidelines regarding ORE's expectations regarding Academic Honesty, the ORE Honor Code, and processes to follow when concerns arise.

Graduate School Standards

- You can find the Graduate School Policies and Procedures listed as "Graduate School Policies and Procedures" on the Graduate School Resource page here:
  Graduate School - Resources & Forms - CU Anschutz
  - Advocacy, Grievance, and Empowerment, Students : Summary, procedures, and forms for reporting grievances, violence, discrimination, harassment, misconduct, and violations of academic integrity or the Honor Code.
  - **Graduate School Policies and Procedures :** Policies and Procedures outlining minimum standards, requirements, and procedures for all Graduate Programs under the auspices of the Graduate School at the CU Anschutz.
    - **Credits:** The Graduate School requires at least 30 semester hours in didactic coursework (core courses, lab rotations/research - CPBS 7650 and program electives) and 30 semester hours of thesis research for the Ph.D. (CPBS 8990). All work undertaken as a graduate student must be in compliance with the academic Code of Honor.

- **Maintenance of a 3.0 GPA:** All students must maintain an average of "B" or better in their coursework. Students are expected to earn a "B" or better in all required courses.
- **Preliminary Exam:** In order to continue in the program, a student must pass the Preliminary Exam prior to starting their second year.
- **Academic Honor Code:** Education at CU Denver | Anschutz is conducted under the honor system. All students who have entered graduate and health professional programs should have developed the qualities of honesty and integrity, and each student should apply these principles to his or her academic and subsequent professional career. All students are also expected to have achieved a level of maturity which is reflected by appropriate conduct at all times. Expectations, definitions, and procedures regarding graduate student conduct are outlined in the Academic Honor Code and the Student Code of Conduct (below).
- **Code of Conduct:** The University strives to make the campus community a place of study, work and residence where people are treated, and treat one another, with respect and courtesy. The university views the student conduct process as a learning experience which can result in growth and personal understanding of one's responsibilities and privileges within both the university community and the greater community. Students who violate these standards may be subject to the actions described below. These procedures are designed to provide learning opportunities dedicated to fairness to all who are involved in the conduct process. As members of the University of Colorado Denver | Anschutz community, students are expected to uphold university standards, which include abiding by state, civil, and criminal laws and all university laws, policies and standards of conduct. These standards assist in promoting a safe and welcoming community; therefore, all students must uphold and abide by them.

- **Student Email Policy** : Guidelines regarding email as an official means of communication (assignment of student email addresses, use of, and expectations of email communication between faculty and student and staff and student).
- **Remedial and Disciplinary Actions:**
  The University of Colorado Anschutz Medical Campus, consistent with most other educational institutions, has a student honor code **https://graduateschool.cuanschutz.edu/forms-resources/resources** . The Computational Bioscience Ph.D. Training Program endorses and enforces this honor code. A student who violates the honor code will be called before the Program Director who may assign disciplinary action, up to and including dismissal from the program. Students whose cumulative GPA falls below 3.0 will be placed on Academic Probation by the Graduate School. They have two semesters in which to raise their GPA to 3.0 or above for removal from Academic Probation. The University of Colorado System Rules require that after a student is put on academic probation, he/she must maintain a 3.0 in all subsequent semesters. Failing to meet either condition will lead to immediate dismissal from the Graduate School. A "B minus" or below in any required course is considered unsatisfactory academic progress, and more than one "B minus" or below is grounds for dismissal from the Program. A graduate student who receives an unsatisfactory grade in a course (a B minus or

below) may be required to repeat that course upon the recommendation of the Program Director and GAC. All grades received will appear on the student's transcript.

The Program Director and/or GAC will meet to determine the student's progress. If the student is performing satisfactorily, they will be removed from probation. If the committee determines that the student has not made satisfactory progress, the chair of the thesis committee, the thesis mentor and the student will meet with the Program Director and/or GAC, and the following determinations will be made:

• the student is not in good academic standing and will be placed on probation again for not more than 30 days.
• the student is not in good academic standing and will be released from the program.
• the student is in good academic standing.

All meetings will be thoroughly documented, and the documentation given to the Program Administrator for placement into the student's file.

The student requirements described in this handbook must be met by the deadlines stated. The Program Administrator and Program Director monitor the progress of each student. If they conclude that a student is not meeting the program's requirements in a timely manner, they may request a meeting with that student. After review, the Program Administrator & Director may take any actions deemed appropriate, including placing conditions on the student's continuance in the program or dismissing the student from the program. If a student is in jeopardy of missing a deadline or believes they are not achieving acceptable progress, the student should contact the Program Director immediately. Failure to notify the Program Director of problems in completing requirements can result in dismissal from the program.

- **Change in Thesis Lab:** If a student leaves a thesis lab (but is still considered by Program Director and GAC to be in good academic standing) the student has the current semester (but no more than 90 days) to relocate to another thesis lab and determine a new thesis mentor. In the event that a new thesis laboratory cannot be identified, the student will be dismissed from the Program.
- **Time Limit of Ph.D. Studies:** Students have **eight years** from the time they enter Graduate School to complete all requirements for the degree. Continuation after six years requires the approval of the student's thesis committee and the Program Director.
- **Disclaimer:** This handbook, which includes parts of the Graduate School Policies, does not constitute a contract with the University of Colorado Denver Graduate School, Office of Research Education, nor with the Computational Bioscience Program, either expressed or implied. The Graduate School, Office of Research Education and the Computational Bioscience Ph.D. Training Program reserve the right at any time to change, delete, or add to any of the provisions or contents at their sole discretion. Furthermore, the provisions of this document are designed to serve as firm guidelines rather than absolute rules and exceptions may be made on the basis of extenuating circumstances.

Office of Research Education

- **Office of Research Education**
- Conflict of Interest (reference to Comps and Thesis committees)
  - Honor Code and Committee Procedures
- **Anschutz Email address communication**
- Student Badge Requirement
- **Financial Aid for Graduate Students**
- Residency
- Tuition, fees and stipend
  - All incoming Graduate Students are offered a financial aid package from the Graduate School that includes an annual stipend of **$41,912** (approved for **2025-2026**), tuition costs, and payment of individual student health insurance and activity fees. The Stipend is evaluated on an annual basis for the cost of living. Please note that this support covers the period July 1,2025, through June 30, 2026 for continuing PhD students, and August 15, 2025, through June 30 for first year PhD students. Payment of annual stipend, along with tuition costs, fees and individual health insurance is dependent upon satisfactory academic progress as defined in the Graduate School and Program policies.

Program Events and Activities

Attendance is required to all the events listed below.

Program Seminar

Attendance at Computational Bioscience Seminar series Wednesdays at 1:00 pm is mandatory. This time will be used by current CPBS Program students, prospective CPBS faculty candidates, and NIH Training Grant T15 postdoctoral fellows. You are expected to attend and sign in before the start of each seminar. All students are expected to attend in-person. Please contact Program Leadership and Program Administrator if you need to miss a seminar or attend virtually.

Update Talks: Students will give an annual report on the progress of their thesis research to the Computational Bioscience Faculty and Students in the form of a 30-minute seminar during their 2nd year. In their 3rd year and beyond students are expected to have 30-45 min talk and time for questions. After completion of the Comprehensive Exam students are required to give a thesis update seminar on an annual basis; thesis advisory committee (TAC) meetings are required annually as well. Update seminars provide a good opportunity for the student's TAC to review the student's progress and to invite input from the faculty as a whole, as well as afford the student opportunities to polish presentation skills. It is the responsibility of the Committee Chair to post a brief critique of the yearly seminar on Predoc Progress Assessment web site - **http://predocprogress.ucdenver.edu/** . Students actively writing their thesis may be exempt at the discretion of the Program Director.

Annual Retreat

The annual program retreat has been held each Spring term and includes participation from all students in one day event. The event is organized by a Retreat Committee composed of students in collaboration with faculty

and program leadership. Its primary purpose is to engage and educate PhD students on computational bioscience–related topics and discuss program initiatives.

The retreat serves as a unique platform for students, postdocs, research staff, and faculty to exchange ideas, receive valuable feedback, and build lasting connections

Student activities

Student lunches are held each Fall, Spring, and Summer term to discuss program updates, student concerns, and new initiatives. These meetings include all students, the Program Director, CPBS Faculty and Program Administrator. Attendance is required for all PhD students.

Training grants

Once accepted into a thesis laboratory, your tuition, stipend, and benefits will be funded by your mentor. It is very important that you successfully complete the required research rotations during the first year, to maintain funding. Students who perform exceptionally well in the first year may be awarded funding from our National Institutes of Health, NLM T15 training grant. In addition to providing tuition, health and dental insurance, and a stipend, the training grant may cover the cost of travel to conferences and computer equipment for your research. The stipend is paid monthly via direct deposit, on the last working day of each month. Appointees to the training grant should be aware that taxes are not withheld, so you should plan accordingly if you are a training grant appointee.

T-15 applications are open during spring semester and requirements may vary each year. Reach out to the T15 PIs, Program Administrator and Program Director for more information.

Resources and Support

Students can access a variety of campus services through the links provided below. The Office of Student Affairs is committed to supporting CU Anschutz students by offering guidance and assistance in navigating campus resources. For detailed information about available services or to schedule an appointment, please visit the Office of Student Affairs webpages. For additional questions or support, you may contact the office via email at StudentAffairs@cuanschutz.edu.

- **Office of Student Affairs**
  - **Campus Life**
  - **Student Support**
  - **Health & Wellness**
  - **Student Resources**
  - **Student Services**
- **Students Resource Directory**
  - Includes all campus resources
- **Academic Calendar**
- **Residency**
- **Badging Office**
- **Student Parking & Transportation**
  - Eco Pass
  - Campus Circulator (Transportation service)
  - Medical Campus Rail Shuttle

- Office of Information Technology
- Student Health Insurance
- Office of Research Education – Concern Reporting Form (Maxient)
- CU Anschutz Student Outreach and Support Referral
- CU Anschutz Student Request for Medical Leave of Absence
- Graduation Deadlines Thesis, Anschutz
- Thesis & Dissertation/ProQuest Format & Guidelines

Appendices

Appendix 1: Medical Scientist Training Program & Biomedical Sciences PhD Program Handbook

Appendix 2: Computational Bioscience Preliminary Exam information and rubric

Appendix 3: Electives

Appendix 4: Comprehensive Exam Information

Appendix 5: Computational Bioscience Program Comprehensive/Thesis Committee Form

Appendix 6: Use of AI in ORE courses

Appendix 7: Program Specific Thesis Defense Guidelines

Appendix 8: Faculty Information/resources

Appendix 9: Useful information for first-year rotations

Appendix 10: ORE policy on External Employment for Graduate Students

Appendix 11: CPBS Mentor and Mentee Mutual Expectations

Appendix 1

- **Medical Scientist Training Program**
  - HANDBOOK
- **Biomedical Sciences PhD Program**
  - HANDBOOK

Appendix 2

➢ Computational Bioscience Preliminary Exam information

The preliminary exam is a broad-based written and computing exam given at the end of each student's first year. It covers the didactic material presented during Core Topics A, B and CPBS 7712, and incorporates a week-long programming problem. The exact format of the exam, time and number of questions, may change on an annual basis but typically, the layout is as follows:

Day One: Short Answer Essays—several questions are presented, and you must answer a certain number of them. These responses from you are due at the end of the day.

Day Two: Long Answer Essay—you are given one question that you must answer fully. This response from you is due at the end of the day.

Day Three: Programming—a programming question is given, and you will have approximately 1 week to develop and submit your computational program and results.

A passing grade is required for continuation in the program. In the case of a failing grade, it is entirely at the discretion of the preliminary exam committee whether to permit re-exam on all or part of the requirement, or to terminate the student's matriculation. Assuming successful completion of the preliminary exam requirement, a student may immediately begin work on their thesis with an mentor.

The statement below clarifies the Graduate School policy on students who do not pass the preliminary exam. Passing the exam requires that a student earn a passing grade on all parts of the exam if the exam is separated into multiple days; failure on either part results in failure of the entire exam. From the Graduate School Policy and Procedures Guide:

"Each Program is responsible for ensuring that students are qualified for doctoral studies by passing a Comprehensive Exam or a combined preliminary and Comprehensive Exam. If a program evaluates students' preparedness with a separate preliminary exam, it must be administered equitably to all students, with the limited exception of programs that require a student to have a master's degree before entering doctoral training; a master's degree may exempt the student from the preliminary exam but cannot exempt the student from the Comprehensive Exam."

In addition to the program having the discretion to allow a student to retake the preliminary exam, the program has full responsibility for designing the compensatory exam and for determining what constitutes a passing grade.

Appendix 3

➢ Electives

Students are required to take a minimum of 30 semester hours of coursework before admission to candidacy. After these required courses and rotations, that leaves a minimum of nine remaining course credits (usually three courses) for electives during the second (or third) year. There are a wide variety of informatics and bioscience courses and programs at the University of Colorado campuses and our students have been very creative at taking advantage of them to pursue specific biomedical and informatics interests. Requires approval of the Program Director and Mentor.

Other Campuses

*Students who would like to take courses offered at another CU Campus, most commonly CU Boulder or CU Denver, must take the following steps, in this order:

1. Email the course instructor to ask for approval to enroll as a student on a different campus
2. Complete the Intercampus Enrollment Form, found on the CU Anschutz Registrar's Website. Email your completed Intercampus Enrollment Form to the Program Administrator, along with a copy of the email from the course instructor showing their approval for you to enroll in the course.

We have organized electives into tracks. Students are required to take 1 computational topic elective (typically 3 credits) and 2 domain electives (typically 3 credits each).

COMPUTATIONAL TOPIC ELECTIVE:

The purpose of this elective is to delve deeper into computational areas related to the student's research (e.g., machine learning, causal inference, network analysis) to learn the theory and implement advanced computational approaches. **Example of courses are listed below** and are offered at the Anschutz campus, Downtown Denver Campus (DDC) and CU Boulder (CUB):

- Machine Learning & Deep Learning: BIOE 5020/5021, BIOS 7747, BIOS 7748, DDC CSCI 5930 & 5931, CUB CSCI 5622 & 6622
- Longitudinal Data – BIOS 6629
- Causal Analysis – BIOS 6641
- Data Visualization – BIOS 7719
- NLP - CSCI 5832 (CUB)
- Multi-agent systems – CSCI 5423, 7000 (CUB)
- Machine Intelligence – CSCI 5822 (CUB)
- Network Analysis – CSCI 5352 (CUB)

This is not a comprehensive list and students can enroll in other suitable courses per the Program Director approval. **MSTP students** have typically met the elective requirement upon entering the program, which should be verified with the Program Director.

DOMAIN ELECTIVES: The purpose of the domain electives is specialized exploration of a domain area relevant to the student's research direction. They can be selected from 4 possible tracks 1) Bioinformatics 2) Computational Neuroscience 3) Imaging Informatics and 4) Clinical Informatics. Below are examples from each track.

1) **Bioinformatics**
   Selected HMGP courses
   Selected MOLB courses
   BIOS 6655 Statistical Methods for Genetic Association Studies
   BIOS 7659 Statistical Methods in Genomics
2) **Computational Neuroscience**
   Selected NRSC course (e.g., NRSC 7501, 7612, 7657)
   ELEC 5375: Eng. Neuro,
   BIOE 5053: Optics and Microscopy;
   Selected CUB courses (APPM 5370 Comp Neuro, ECEN 5811: Neural Signals, ECEN 5831: Brains, Minds and Computers)
3) **Imaging Informatics**
4) CSCI 5931 Deep Learning
   ELEC 5541 DL for Comp. Vision
   CSCI 5722 Computer Vision (CUB)
5) **Clinical Informatics**
   BIOS 6310: Practical Clinical Research Informatics
   Selected NURS courses (6284, 6285, 6279, 6293)
   Selected CLSC courses (6060, 6080, 6800, 6820
   Selected CUB courses (CSCI 5919, 5920 Human Comp. Interaction)

   This is not a comprehensive list and students can enroll in other suitable courses per the Program Director approval. Also, if a student is participating in research across or outside these domain areas, the student can create a custom elective track per the Program Director and Advisor's approval.

Appendix 4

➢ Comprehensive Exam information

The University-based Comprehensive Exam is an orally defended Doctoral thesis proposal typically taken by the end of the student's third year in the program. It is based on the student's doctoral thesis proposal but can include other areas of study as well. This exam typically takes the format of presenting the problem, defending its innovation, and demonstrating a workable knowledge of the field of study to assure that independent work is eminent.

The student's Comprehensive Exam committee judges the quality of the exam and makes recommendations for further academic advancement.

It is necessary that students complete all coursework or finish all coursework in the same semester as the exam, pass their preliminary exam, and have a doctoral thesis topic before they can schedule their Comprehensive Exam. After successfully completing this exam and meeting all other Graduate School requirements, students are recognized as formal Ph.D. candidates who can proceed with their independent research work that will ultimately culminate in their Ph.D. dissertation.

You must be registered for coursework during the semester in which the exam is taken.

The Comprehensive Exam contains three major components:

1. The written Doctoral thesis proposal
2. The Doctoral thesis proposal presentation
3. The oral exam and defense of the Doctoral thesis proposal.

After completing or registering for all program-required non-doctoral thesis coursework, and concurrently with applying for admission to candidacy for the Ph.D., you must take a Comprehensive Exam in your field of concentration and related fields. This exam (written and oral) will test your mastery of a broad field of knowledge, not merely the formal coursework which you have completed. Students should plan to take this exam by the end of their third year of study. **If you would like to take the exam after the end of your third year, you must get approval from the Program Director and communicate to the Program Administrator that an extension has been granted.** Under extenuating circumstances, and with the recommendation of the Program Director and concurrence of the Dean, the exam may be taken later than the conclusion of a student's third year of study. A student cannot take the Comprehensive Exam with less than a 3.00 G.P.A. or before the Graduate School application is submitted and approved. The complete policy and procedure for taking the Comprehensive Exam is listed on the Graduate School website in the Policies & Procedures guide.

The necessary steps to schedule and take the Comprehensive Exam are as follows:

1. **Form a Comprehensive Exam Committee**
   Shortly after selecting a thesis mentor, you, in collaboration with your mentor, shall recommend a Comprehensive Exam Committee (CEC) subject to approval of your Program Director, and reported to the Program Administrator. You must have 5 committee members, and a majority of the committee must be members of the program. In rare exceptions, a larger committee would need to be approved by the PD, but it must always be an odd number of members. You must have at least one outside committee member; an outside member is someone who is not core program faculty. Your faculty mentor may or may not be a member of the committee, but they cannot be the chair of the committee. You should also disclose, in writing, if any of your committee members may have a (perceived) conflict of interest in serving on your committee. Examples of potential conflicts of interest may include: financial relationships (such as a committee member who is employed in the lab of your faculty advisor, or a current or former employer serving on your committee) and familial relationships. Although it is recommended that the Doctoral Thesis Advisory Committee be the same as the Comprehensive Exam Committee, the two committees need not be identical.
2. **Submit a Doctoral Thesis Proposal**
   Before taking the Comprehensive Exam, you must submit a doctoral thesis proposal to the Program Director and to the Doctoral Thesis Advisory Committee at least two weeks prior to the scheduled exam date and schedule the exam with the Graduate School by filing all the required Graduate School forms**.**

A doctoral thesis (written presentation of novel research) is based on original investigations and showing innovation in computational bioscience methodology. The doctoral thesis proposal should be in a format comparable to a National Institutes of Health (NIH) R03 grant submission and should be between 6 and 12 pages long. (http://grants.nih.gov/grants/funding/r03.htm). It is recommended to follow the NIH guidelines to include sections on Significance, Innovation, and Approach. Your Comps paper proposal should:

- Contain an argument regarding the significance of your work
- Address several aims of your work
- Explain your approach to those aims
- Acknowledge likely pitfalls/fallbacks

3. **Complete the Graduate School Comprehensive Exam Forms**

The Graduate School requires 2-3 forms to be submitted in order to take the University Comprehensive Exam. All forms and information are located on their website at: https://graduateschool.cuanschutz.edu/forms-resources/resources all documents need to be submitted via **DocuSign**, no PDF files will be accepted.

The following must be submitted to the Program Administrator at least one month prior to your exam:

1. Application for Candidacy form
2. Exam Request form
3. Transfer of credit form (if applicable)

DO NOTWAITTOFILLOUTFORMS—the one-month deadline is hard and if something is amiss with your paperwork you may be required to reschedule your exam date.

STARTEARLY- Please start early to schedule exam dates, it can take several months' notice to find times that work for the entire committee. Furthermore, other committee members, especially members who have not been on a CPBS committee before, may need to fill out forms from the Graduate School that need to be approved before the exam.

Comprehensive Exam Format

In seminar format, students will present material from the Doctoral Thesis Proposal to their committee members and the general public. The presentation should last **40-45 minutes** and allow time for general questions; then entire seminar plus questions should not exceed one hour. Shortly after the presentation is complete, the public audience members will be dismissed, and the oral Comprehensive Exam will begin. This oral exam will test your mastery of a broad field of knowledge, not merely information from your thesis proposal or the formal coursework which you have completed.

Appendix 5

➢ Computational Bioscience Program Comprehensive/Thesis Committee Form

Please fill out the following form and distribute it to your Committee members and Program Administrator no later than one week prior to each committee meeting. This form will serve as a record of your accomplishments and your progress toward completion of your thesis research.

Upon completing this form, please make sure to update your student profile in GAIA with any changes, additions or accomplishments.

Students are required to meet with their committee on an annual basis and highly encouraged to meet with their committee every six months.

Student Name:

Year started graduate school:

Year started thesis project:

Year of comps: Meeting date:

Committee members (note chair):

Thesis mentor:

Title of project: Hypothesis:

Specific aims:

Summary of progress since last meeting (organize by aims, as appropriate; discuss any changes in direction; include response to any major critiques from last meeting)

Manuscripts: type and status (primary/review; in prep, submitted, under review, in revision, in press) Meetings, abstracts and form of presentation (poster/talk)

Fellowships/ Grants (funding agency, name and dates of grant, title of project, total direct costs)

Other experience, accomplishments (Use additional pages as needed)

Individual Development Plan (IDP: https://myidp.sciencecareers.org should be updated on an annual basis (at least) and included here for every committee meeting).

Appendix 6

➢ Use of AI in ORE courses

USE OF AI FOR EDUCATION/TRAINING IN THE ORE PHD PROGRAMS
UPDATED Oct. 29th, 2024

Guidelines for the Use of AI and Machine Learning Tools
(adapted from CSD and MOLB guidelines).

The core course, preliminary exam, and Comprehensive Exam feature writing exercises where students are instructed to develop and refine original research ideas and proposals. These exercises are key to students' development as scientists. Writing exercises are designed to sharpen skills in synthesizing foundational knowledge, critical thinking, navigating and understanding literature, creativity, and clearly and succinctly communicating your ideas through writing.

Advances in generative Artificial Intelligence (AI) language models have created tools with the potential to enhance scientific writing, including accelerating the writing process and reducing barriers to non-native English speakers. However, these tools also come with pitfalls, including falsified or inaccurate information, breaches of confidentiality, and plagiarism issues. Importantly, improper use of AI tools can potentially undermine the learning objectives of coursework and create inappropriate advantages for some students over others.

This policy establishes guidelines for acceptable and unacceptable use of AI language model tools in the core course. Our goal is to promote acceptable use of new technology while maintaining our overall goals and standards for training. Follow these guidelines to avoid course failure. Any questions regarding this policy and its implementation should be directed to the Course Director.

ACCEPTABLE USE

1. Language and grammar checks. AI tools can be used to check your drafts for grammatical errors. This provides an opportunity for you to learn rules and best grammatical practices.

2. Programming language checks. AI tools can be used to check your code and for debugging.

3. Identifying articles related to a topic of interest. AI tools can be used to identify literature related to a particular topic. Consider this a starting point to direct you to new literature. Your job is then to read this literature, evaluate it, synthesize the content, and use that synthesis to develop a rationale for your original ideas and experimental plans. Be honest and transparent about the use of AI tools in coursework. Citation of any use should be included in the bibliography of your written assignments and include the name of the specific tool (and version) and how it was used. Ex: ChatGPT, v4 was used to evaluate the grammar in this proposal. Suggestions from this evaluation were

included in the final draft.

UNACCEPTABLE USE

1. Drafting outlines or paragraphs for research proposals. Writing assignments in core are an expression of your original thinking and writing ability. You may not use AI tools to identify proposal topics or to generate potential experiments for the proposal. You may not use AI tools to generate new written content in your proposal. Although AI tools can be used to evaluate the grammar of your own original written content and make suggestions to improve grammar and clarity, they cannot be used to generate new sentences for your writing assignments. Verbatim use of sentences generated by AI tools will be considered plagiarism.

2. Drafting peer review summaries. You may not use AI tools to generate summaries or reviews of your classmates' work. Peer review is an excellent opportunity to sharpen your critical thinking and evaluate alternative ideas on a topic, and it provides a unique opportunity for practicing concise written communication. Use this opportunity to consider the proposal from your peer and provide your own perspective. Using AI tools to generate summaries or reviews denies you this opportunity, and denies your peer from gaining your perspective. Furthermore, uploading content from another individual's proposal to an AI tool may violate confidentiality, as the uploaded content may be disseminated or used for other purposes and without your consent. NIH has recognized this threat and recently adopted a policy that prohibits the use of generative AI technologies for the peer review process (https://grants.nih.gov/grants/guide/notice-files/NOT-OD-23-149.html).

Other Resources:

Brandeis University

https://www.brandeis.edu/teaching/resources/syllabus/ai-statements.html

UT Austin

https://ctl.utexas.edu/chatgpt-and-generative-ai-tools-sample-syllabus-policy-statements

University of Chicago

https://teaching.uchicago.edu/sites/default/files/2023-09/CCTL_AI%20Syllabus%20Statements.pdf

Appendix 7

➢ Program Specific Thesis Defense Guidelines

Doctoral Thesis Update Seminars

After completion of the Comprehensive Exam students are required to give a thesis update seminar on an annual basis; thesis advisory committee (TAC) meetings are required annually as well. Update seminars provide a good opportunity for the student's TAC to review the student's progress and to invite input from the faculty as a whole, as well as afford the student opportunities to polish presentation skills. A student in consultation with their mentor, and with the approval of the Program Director, should select an outside committee member (see below) by the date of the first thesis update (i.e., on or around one year in the thesis laboratory). Following each committee meeting, regardless of whether the student gives a public presentation, the student and TAC chair will complete an assessment that summarizes what the committee discussed in the meeting. Annual meetings with the TAC are mandatory but meetings every six months are strongly encouraged.

Thesis Advisory Committee

The thesis advisory committee (TAC) meets with and advises you until your thesis defense. The TAC is often the same as the Comprehensive Exam committee (CEC), but there may be a need to change the make-up of the committee. The TAC will serve as an advisory function to you and your mentor and shall also monitor your progress in generating and/or collecting data to be used in the writing of the doctoral thesis. Your thesis mentor will give you formal permission to write the thesis once sufficient data have been collected and analyzed. The Doctoral TAC shall meet at least once each year, usually during the student's thesis update talk. Records of the meetings and of your progress are maintained; notify the program administrator in writing of your meetings. Your TAC must have 5 committee members, and a majority of the committee must be members of the program. In rare exceptions, a larger committee would need to be approved by the PD, but the TAC must always be an odd number of members. You must have at least one outside committee member; an outside member is someone who is not core program faculty. Your thesis chair must be a regular faculty member of the program and cannot be your thesis mentor. Your faculty advisor may or may not be a member of the committee, but they cannot be the chair of the committee. You should also disclose, in writing, if any of your committee members may have (perceived) conflict of interest in serving on your committee.
Examples of potential conflicts of interest may include financial relationships (such as a committee member who is employed in the lab of your faculty advisor, or a current or former employer serving on your committee) and familial relationships. Although it is recommended that the Doctoral Thesis Advisory Committee be the same as the Comprehensive Exam Committee, the two committees need not be identical.

You are required to meet with your TAC at least once per year (although more frequent meetings are encouraged) to monitor the progress of the project and to provide additional input and suggestions. The student must take the initiative in scheduling TAC meetings. After each committee meeting, the student will complete the Thesis Advisory Committee Meeting Summary with their TAC chairperson. This web form must be completed no later than the two weeks following the TAC meeting. If the TAC meeting is accompanied by an annual presentation, then both the presentation and the meeting forms must be completed at http://predocprogress.ucdenver.edu.

Thesis Defense

The student's doctoral thesis advisory committee conducts the "Defense of Dissertation" after completion of the independent research. Arrangements for the final exam must be made with the Graduate School, via the Program Administrator, at least one month in advance. Required paperwork are the "*Biosketch*" and "*Exam Request*" forms found on the Graduate School's website (https://graduateschool.cuanschutz.edu/forms-resources/resources) please use the link to be sure you are accessing and completing the most up-to-date version of those forms. Please check with the Program Administrator at least one month in advance of your scheduled defense date to ensure all committee members have faculty appointments with the Graduate School.

This doctoral thesis document must be written, approved by an examining committee authorized by the program, and in a final format approved by the Graduate School. A near final draft of the work is submitted to the exam committee at least two weeks prior to the final oral exam (Defense of Dissertation). The exam committee must formally approve the dissertation before the candidate submits a final and appropriately formatted version of the dissertation to the Graduate School. All Graduate School guidelines and specifications must be followed. Students must register for and complete 30 semester hours of doctoral thesis credit (CPBS 8990) to be eligible for the Ph.D. degree; additionally, students must be registered for 5 credits of CPBS 8990 in the semester in which they defend their thesis (which counts towards the required 30 credits of CPBS 8990).

Upon successfully defending the innovation of the problem and student's independent research efforts, the Ph.D. candidate must complete all the contingencies and formal recommendations of the doctoral thesis advisory committee and the Program Director. A final grade for the 30 semester hours of thesis research is assigned only after the student submits the final, approved manuscript, documenting the completed, innovative and independent research work to the Dean of the Graduate School. If approved by the Graduate School, the Dean of the Graduate School makes a recommendation to the Chancellor, on behalf of the entire graduate school faculty, who then awards the Ph.D. degree to the candidate.

Graduate School Policies for Thesis Exam Results

Pass

You must receive the affirmative votes of a majority of the members of the committee in order to pass.

Pass with Conditions

The committee may feel that, although you have passed the exam, you should complete additional work. This may be in the form of rewriting submitted work, additional coursework, etc. The Graduate School requires that these conditions be satisfied within sixty days; however, the student's committee may require the conditions in a shorter time frame. Under extenuating circumstances, the graduate Program Director may petition the Graduate School for additional time. You will be considered to have "passed" when these conditions are met. Failure to meet the conditions will result in failure of the exam.

Fail

In the event that you fail the exam, the student may not continue in the program unless a time extension is supported by the program in writing for a retake of the defense. You will be required to meet registration requirements for the new exam.

Appendix 8

- **Faculty information/resources**
  - **Quick Reference table for membership**
  - **Computational Bioscience Faculty and Research | School of Medicine**

Appendix 9

- **Useful information for first-year rotations**

Rotation Student Lab Questionnaire

1. How often and when should I expect to meet with the lab PI? What should I prepare in advance that I should bring to those meetings (notebook, raw data, slideshow presentation, written summary of completed work)?
2. How should I communicate with the PI outside of scheduled meetings?
3. Who is the best person in the lab to consult for day-to-day technical advice?
4. Where can I find descriptions of standard lab protocols for coding?
5. What is the expectation for the hours/days I should be working in the lab, in my rotation and if I were to join as a permanent member?
6. What is the preferred software language, code documentation and report format for the lab?
7. Is there a weekly lab meeting or other lab/department events that I should be aware of?
8. How can I contact someone with a lab question after hours?
9. How should I store digital data and code files from my research in the lab?

CPBS Rotation Project Proposal Template

All rotation forms must be submitted 1-2 weeks after starting your rotation.

Student Information

Student ID First Name Last Name

Rotation Information:

Rotation: Year: Program

Rotation Start Date: Rotation End Date:

Rotation Mentor: Rotation Co-mentor, if applicable:

Program Questions

Rotation Project Title:

Background:

Hypothesis to be tested:

Specific Aims (2-3)
Please submit 2-3 Specific Aims, each of which consists of 2-3 sentence statements and/or bullet points, of the major goals of the aim and the methods for achieving the aims. The specific aims should be modest in scope, to increase the likelihood of achieving the aims during the rotation.

Below is an overview of the automated form process. Steps in bold are your responsibility as the student:

1. **You will initiate the process by selecting the mentor with whom you wish to rotate.**
    - This step includes program-specific questions, such as outlining your rotation goals.
    - Be sure to follow your program's timeline when submitting the form.
    - **Rotation Form Link**
2. The form is automatically sent via email to the selected mentor.
    - The mentor will review your proposal and indicate their acceptance with a yes/no response and a signature.
3. The form is then automatically routed to your Program Director for final approval.
    - All parties (you, the mentor, and the director) will be notified once approval is granted.
4. One week before the rotation ends, the mentor will receive an email containing a link to your original proposal along with a performance assessment rubric.
    - The mentor will complete the rubric to evaluate your rotation performance.
5. A copy of the completed Post-Rotation Assessment will be sent to you, your Program Director, GAC Chair, mentor, and program administrator.

Important: Because this system contains sensitive student data, you must be on campus or connected via VPN to access and complete the form.

Rotation Assessment Template

We highly recommend that students meet with each rotation mentor to review their performance during their rotation. This is an excellent opportunity for students to provide feedback on their mentors as well.

Instructions

Good mentoring of students includes constructive feedback on how they can continue to improve as scholars and scientists. We hope you are having these discussions with your rotation students, and that these same constructive comments will turn up in these evaluations. Too often students have been surprised and mystified by not being offered positions in labs at the end of their rotations and it would be extraordinarily helpful to all concerned if all faculty members would provide students with thoughtful input both in person and in these evaluations.

Assessment

Please rate the student's performance on the following:

1. Intellectual engagement in research area*
   ◯ A ◯ B ◯ C ◯ D ◯ F

   Comments*

2. Accounting for coursework, effort on research participation*
   ◯ A ◯ B ◯ C ◯ D ◯ F

   Comments*

3. Areas of Strength*

4. Areas for improvement*

Assessment Attachments (0)
Attach supporting documents.

Grade & Completion Date
As the selected mentor for this rotation, my suggested overall grade is:*
◯ A
◯ A-
◯ B+
◯ B
◯ B-
◯ C
◯ I

Mentor Name/Signature* Rotation Completion Date*

Rotation Talk Evaluation

Rotation talks are scheduled the Wednesday after the end of the rotation

(3 talks for the academic year)

The purpose of the rotation talk evaluation is to provide constructive feedback for students to improve their oral communication skills.

Please provide constructive advice on:

1. Content of the talk
   Introduction – does the student state the "big problem" and provide appropriate background?

   Hypothesis- is the hypothesis stated and are experimental approaches clearly explained?

   Data –Does the student explain the data clearly and summarize the findings from each data slide? Do they draw attention to what is important?

   Conclusions – Does the student relate the data back to the "big picture"? Do they do a good job of describing future directions?

2. PowerPoint Presentation
   Slides – are the images easy to see (words, graphs, images, etc.)?

3. Interaction with the audience
   Does the student engage with the audience (eye contact)?

   Does the student do a good job of handling questions from the audience?

4. What did you really like about this presentation?

5. What can be improved?

Appendix 10

➢ ORE policy on External Employment for Graduate Students

Background

Graduate students admitted to ORE Programs receive an annual stipend, health insurance coverage and full tuition. They are considered full time students and, per NIH policy, expected to devote a minimum of 40 hours to their PhD training.

Students may wish to take on additional paid employment for financial reasons or to gain experience in teaching, industry or explore other career opportunities. This may be complementary and beneficial to their training and professional development in University of Colorado graduate programs.

In the past students have taken on additional external employment, in some cases becoming self-funded and essentially full-time employees of another company or institution, while simultaneously attempting to complete their PhD training at the University of Colorado. This has been detrimental to academic progress and the student-mentor relationship.

There are currently no guidelines or policies regarding Graduate students engaging in external employment.

Policy

Graduate students, **in good academic standing**, may, **with appropriate approval**, work a **maximum of 10 hours per week.**

Such employment must **be approved in advance in writing** by the Students Program Director for first year students and by Program Director and Thesis Mentor for those students who have entered a laboratory or who transfer or are directly admitted to a laboratory.

The Office of Research Education and the Students mentor/ thesis committee must also be informed of any students approved for external employment.

External employment must not conflict with any required elements of a student's PhD training. Examples include but are not limited to: classes, assessments, seminars, journal clubs, lab meetings, retreats and other required program or ORE activities.

Students **must remain in good academic standing** in order to continue their external employment.

Approvals must be reviewed and reported by the student's Program and Advisory committee every 6 months. Students will attest that they have not exceeded approved hours.

Students receiving extramural support for their PhD from training grants or other sources are subject to the requirements and policies of those funding entities and may not be eligible for external employment.

Failure to disclose external employment, falsely reporting or willfully exceeding approved hours will be grounds for disciplinary action and possible dismissal from the PhD program.

Definitions

External employment- any paid (or compensated in kind) work or work product outside of a student's PhD training program and the Office of Research Education.

Good academic standing-maintaining a minimum of a B grade in all classes, rotations and thesis work. Passing Preliminary and Comprehensive Exams. Meeting other Program requirements, as described in Program Handbooks. Demonstrating satisfactory and timely progress toward the PhD, as determined by the Students Advisory/Thesis Committee.

Resolution of problems

Students may appeal denial or rescinding of approval for external employment on the basis that policies were not followed or applied fairly. Appeals will be reviewed by the Associate Dean for Research Education and their decision will be final.

Appendix 11

- **CPBS Mentor and Mentee Mutal Expectations**

Things that lab members can expect from their faculty mentor

Scientific

- Provides advice regarding design of hypotheses aims, experimental design and computational approach
- Provides feedback when reviewing results and assists with interpretations and future plans
- Stays up to date with current literature in the field and is willing to discuss presentations, meetings/seminars.
- Has early and ongoing discussion regarding the hypothesis of the project and aims and experiments
- Meets weekly with student and provides student the opportunity to have additional meetings and present to the group in lab meetings.
- Actively searches for funding opportunities (T32s, F31 and others) and helps you with these grants and writes letters of recommendations and mentor section.
- Helps you to choose Comprehensive Exam and Thesis Advisory Committee members if you join the lab.
- Timely advice, evaluations and letters of recommendations
- Helps you network with faculty on campus or at other institutions if you need to learn a new approach that the lab does not do.
- Helps you meet scientists from other institutions at meetings and make connections/ networking

Leadership

- Can delegate tasks when appropriate
- Provides a neutral forum for discussing both scientific and lab issues
- Shows discretion at all times
- Shows professionalism at all times
- Addresses problems as they arise
- Is available for meetings and questions

Things that faculty look for and expect from lab members:

Scientific

- Do you display a good level of interest in the scientific topic.
- Are you careful to plan and document your code, methods and results and keep files well organized in folders on the server and/or electronic lab notebook.
- We want to see that you are starting to critically evaluate your methods and results. Do appropriate statistics and attempt to interpret and present at lab meetings for feedback. Do not just say “well it didn’t work – I don’t know why,” but rather think about whether appropriate controls indicate that we can interpret the experiment adequately. Think about what might be

done differently the next time. Keep in mind that if you change more than one thing, you will not know why the result changed.
- Are subsequent approaches logical extensions of previous work?

Work habits

- Communicate regarding work hours and vacations.
- Is work planned efficiently to optimize the amount that can be done carefully?
- Are methods well planned and performed in a conscientious manner?
- What use is made of waiting periods for complex computations to compete? Study or read literature.

Keeping up with the literature and other research.

- Do you routinely search for and read papers from the lab or other labs that work on similar/related topics?
- Do you read papers provided for journal club or other papers that the mentor or lab members suggest?

Creativity and initiative

- Try to provide input into the design, method and execution of your work?
- Don't be afraid to ask questions in lab meetings and seminars.
- How often do you suggest new approaches or new lines of analysis for your current project
- How much personal responsibility and initiative do you take for meeting deadlines, designing and interpreting of results, and writing manuscripts, reviews, and grants (later once you are a permanent member of the lab)?
- If you see a problem in the lab, what is your response (ignore it, complain, suggest a solution)?

Communication skills

- How effective are your lab meeting presentations and rotation talks?
- How do you respond to feedback from the mentor and other members of the lab?

Interactions with others

- Do you take notes when learning approach from someone in the lab?
- Do you leave the shared spaces clean and organized?
- Are you collegial with lab mates when you ask for help or receive/give feedback?