



GRADUATE PROGRAM IN COMPUTATIONAL BIOLOGY HANDBOOK FOR Ph.D. STUDENTS

1. INTRODUCTION:

This document is intended to provide a description of the Brown University graduate program in computational biology. The aim is to spell out the guiding principles of the program so that graduate students understand what is expected of them and what they can expect from the program and to answer some of the commonly raised questions about policies and procedures. However, the authoritative source for Graduate School policies is the Brown Graduate School Handbook which can be found on the [Graduate School website](#).

2. GOALS AND STRUCTURE OF THE PH.D. PROGRAM IN COMPUTATIONAL BIOLOGY:

The Center for Computational Molecular Biology (CCMB) offers Ph.D.s in Computational Biology to train the next generation of scientists to perform cutting edge research in the multidisciplinary field of Computational Biology. During the course of their Ph.D. studies students will develop and apply novel computational, mathematical, and statistical techniques to problems in the life sciences. Students in this program must achieve mastery in three areas - computational science, molecular biology, and probability and statistical inference - through a common core of studies that spans and integrates these areas.

The Ph.D. program in Computational Biology draws on course offerings from the disciplines of the Center's Core faculty members. These areas are Applied Mathematics (AM), Computer Science (CS), the Division of Biology and Medicine (BioMed), Brown Center for Biomedical Informatics (BCBI), and the School of Public Health/Biostatistics (SPH). Our faculty and Director of Graduate Studies (DGS) work with each student to develop the best plan of coursework and research rotations to meet the student's goals in their research focus and satisfy the University's requirements for graduation.

3. ADMISSIONS:

This Ph.D. program assumes the following prerequisites: mathematics through intermediate calculus, linear algebra and discrete mathematics, demonstrated programming skill, and at least one undergraduate course in chemistry and in molecular biology. Exceptional strengths in one area may compensate for limited background in other areas, but some proficiency across the disciplines must be evident for admission.

Students wishing to enter the CCMB graduate program will address their applications to the [Graduate School](#). The purpose of this is so that when the Graduate School forwards the applications to the CCMB for evaluation we can make sure the relevant faculty members are on the Admissions committee to review the application.

The graduate admissions process will be led by a CCMB Admissions Committee including representatives from each of the participating programs (AM, CS, BioMed, SPH and BCBI). Issuance of admission offers will be coordinated by the CCMB with the Graduate School. Matriculating students will commit to fulfilling the course requirements and program



deadlines in the sections following. This program is designed to foster interdisciplinary exchanges between graduate students, and thus every effort will be made to welcome a cohort that is diverse in racial, cultural, and economic background.

4. ADVISING:

A Ph.D. is nothing more than a succession of committee meetings, the goals of which are to advise the student as they move through the various stages of the program. To this end, first year students meet twice with an advisory committee consisting of CCMB faculty trainers from each area of study, and thereafter at least annually with their thesis committee (consisting of faculty chosen by the student), culminating in a thesis defense to take place roughly five years after matriculation. This schedule does not preclude additional meetings if needed; indeed, students are encouraged to work with their full committee and/or subset of members as needed.

With the exception of the two first year advisory committee meetings, it is the student's responsibility to constitute and schedule all committee meetings. Each August the Center will remind each student of these expectations.

5. YEAR 1:

On the day before the start of classes in the fall, all first year students will meet individually for 30 minutes with the Computational Biology advisory committee. These meetings will be scheduled by the CCMB administration, and the committee will consist of the program Director(s) of Graduate Study (DGSs), and at least one faculty representative from each participating program (AM, CS, BioMed, Biostats and BCBI). The agenda of this meeting will be to discuss the student's planned coursework, teaching, research rotations and fellowship applications. Expectations for each of these elements are described next. Exceptions to any of these requirements may be made by the advisory committee.

At the end of the second semester, the advisory committee will be contacted by the DGS to review the progress of the current first year students, as well as the faculty members overseeing the lab rotations performed by the students. The purpose of this second meeting is to assess the student's progress in each of these four areas as well as their lab work. Possible membership on the student's thesis committee will also be discussed at this time.

Students will receive a brief, written summary of both advisory committee meetings prepared by the program coordinator approximately one week after the date of the meeting.

6. REQUIRED COURSEWORK:

Coursework for the Comp Bio Ph.D. students focusing in the area of BioMedical Informatics are discussed with the DGS for that program. All other CompBio Ph.D. students should complete six courses by the end of their second year, meeting the following criteria. In addition, it is important to note that all students should sign up for 4 credits in each of their first six semesters in the program. This is to be accomplished by registering for BIOL/CSCI 2980 Independent Research each semester for as many credits as needed to meet this requirement. For example, many students will register for for APMA 1080, and CSCI 1810 in



their first semester; such students would then also register for two credits of BIOL/CSCI 2980. The breakdown of courses is covered below.

A) Four computational biology graduate courses from the offerings taught by our core and affiliate faculty as approved by the DGS and advisor. These courses must include at least one from each of the four areas: Biology, Computer Science, and Applied Mathematics & Biostatistics offered through the SPH. At most one course can be at the undergraduate course 1000-level, the remainder of courses should be taken at the graduate 2000 level. **NOTE:** some 1000-level courses can be taken for 2000-level credit in accordance with the guidelines of the instructor, when starting the class discuss with your instructor what the additional requirements will be for 2000 level credits.

B) Two additional graduate (2000-level) courses selected by the student in consultation with their advisor and the DGS. Students in their second year are strongly encouraged to take BIOL 2150 the Scientific Communication course as this will prepare year 2 students for the qualifying exam as they will prepare the research proposal as part of the course that is part of the qualifying exam itself.

7. ANNUAL EVALUATION:

The purpose of the annual evaluation process is for students to develop and reflect on their research and professional development goals, and to develop timelines for the coming year. Writing annual reports and being evaluated are also professional development skills in themselves. Faculty members are evaluated annually as the basis for salary raises, junior faculty are evaluated for tenure and promotions, and funded projects require annual reporting to granting agencies. The process of being evaluated is uncomfortable for many, so experience with reporting and evaluation in a supportive environment can help develop valuable skills and perspectives.

The process proceeds according to the following numbered schedule:

1. Students submit their responses to the annual Individual Development Plan (IDP) through the Google form on or before the first Friday in November.
2. Advisors and students have individual meetings to discuss progress and activities over the past year, and strategies for the current year, based on the IDP questions, and the advisor prepares their notes for the Annual December review of Ph.D. students.
3. Faculty meet for 3 hours early in December to discuss student progress.
4. In consultation with faculty advisors, the Center Manager and the DGS(s) prepare annual review letters for each student. These are submitted to the student prior to the start of the Spring Semester.
5. Student completes the Response Form (attached to their letter) within one week of receiving their annual review letter. The annual review letter and student responses become part of the student's Computational Biology and graduate school files. The letter will typically not be modified based on the student's response; instead they both go into the file.

The contents of the student's Annual Report depend on how far the student has advanced in

the program, as the numbered lists below detail:

Students in year 1

1. current CV, together with a 2-3 sentence blurb describing research interests for the Department website.
2. report form from the First Advisory Committee meeting.

Students beyond year 1 who have not yet passed the qualifying exam

1. current CV, together with a 2-3 sentence blurb describing research interests for the Department website.
2. report forms from Advisory or [Thesis Committee](#) meetings held in the past year
3. Update their digital CV in the Graduate School's online system
4. Register for BIOL 2150 Scientific Communication to prepare for the qualifying exam at the end of year 2.

Doctoral students who have advanced to candidacy (passed qualifying exam)

1. current CV, together with a 2-3 sentence blurb describing research interests for the Department website.
2. date(s) of thesis committee meetings completed in the past year.
3. title and a short narrative for each thesis chapter including:
 - a. statement of research question
 - b. methods or approach
 - c. progress to date
 - d. what still remains to be done(length of narrative for each chapter should be about ½ page; abstracts from completed manuscripts or publications may be submitted instead of narrative)
4. Responses from the IDP form
5. timeline for completion of all thesis chapters and professional development goals and date of most recent thesis committee meeting (or scheduled date for the near future)

In the annual review faculty meeting, the faculty discuss the student's annual report, and listen to feedback from other relevant faculty. Based on this discussion, the DGS(s) prepare and submit a letter of evaluation to each student in the program. There are three potential outcomes of this process: 1) a student can be judged to be in good standing, and recommendations for the upcoming year will be provided, 2) a student can be judged to be in satisfactory standing, and tangible steps (and deadline) will be articulated for returning to good standing, or 3) a student can be placed on warning status, and tangible steps (and deadline) will be articulated for returning to good or satisfactory standing.

A student not in good standing is required to make the recommended changes on the timeline provided in their annual review letter. They will be reevaluated by their advisory or thesis committee as soon as is practical after the deadline specified in the annual review letter, to determine whether the student's status should be modified. Students on warning who fail to improve in status may be asked to leave the program, at the discretion of their committee in



consultation with the DGS(s).

7. TEACHING OPPORTUNITIES FOR GRADUATE STUDENTS:

All students are expected to serve as teaching assistants (TAs) in at least one course. This requirement is to be satisfied as quickly as possible, but in any case before the qualifying exam (see below). Students interested in additional teaching opportunities are encouraged to discuss possibilities with their research mentors and the program DGSs.

8. RESEARCH ROTATIONS:

Students are required to complete at least two research rotations of at least eight weeks duration by the end of their third semester in the program. These rotations must take place with faculty advisors in at least two different programs (i.e., APMA, CS, BioMed, BCBI or SPH). The goal of research rotations is to allow the student to identify a thesis advisor. Student progress in rotations is discussed as part of the annual Ph.D. review meetings with faculty in December.

The list of computational biology trainers can be found on the CCMB website ([here](#)): the Center Director, and all core and affiliate faculty are eligible to serve in this capacity. Moreover, students interested in working with Brown faculty not on that list are encouraged to speak with the DGS(s) or the Center Director about that possibility. **NOTE:** M.D./Ph.D. students have different requirements for rotations as they have to balance clinical rotation requirements from the Medical School. This will be addressed on an ad-hoc basis by the DGS and the student's advisor(s).

9. FELLOWSHIP APPLICATIONS:

All eligible students are expected to apply for all relevant predoctoral fellowships (e.g. NIH F30 or F31, NSF Graduate Research Fellowship). A partial list of fellowships can be found on the "Helpful Links" page of the CCMB website ([here](#)). Students are advised to begin this process early, especially because many fellowship proposals must be submitted on the applicant's behalf by the Brown BioMed Research Administration or Office of Sponsored Programs. Both of these offices require several days advance notice. Click [here](#) for further details. **NOTE:** M.D./Ph.D. students are more limited in their timeframe to apply for F30/31 fellowships due to the 48 month after matriculating deadline from the NIH.

The Graduate School has a full page of very [helpful links for graduate students](#), including a section on Funding, Appointments, and Grants which has examples of past successful NIH F30/31 applications.

10. YEAR 2 AND AFTER:

Students are expected to invite faculty members to participate and convene their thesis committee for the first time early in their second year in the program. Membership on this committee will be determined by the student in consultation with the advisory committee, rotation supervisors and any other interested faculty. All thesis committees are required to have at least four members. At least three must be Brown faculty, at least two of which must



be from two different participating programs: APMA, CS, School of Public Health, BioMed or BCBI.

The focus of this first meeting is to assist the student in defining a viable thesis project. Students are expected to meet again with their thesis committee at least once in the spring of their second year in preparation for their qualifying exam (see next). After each thesis committee meeting, the chair of the committee should [submit a feedback](#) form to the DGS and Center Administration.

11. QUALIFYING EXAM:

The form and structure of the Comp Bio Ph.D. Qualifying exam consists of three sections. The first will be a 20 minute presentation by the student for the committee members on their research project and methods. The second section will be reading analysis and comprehension where the members of the student's advisory committee will put forth 3-4 papers to be read and discussed by the student and committee. The third section is a 6 page written proposal of research in the NIH format to be prepared as part of the BIOL 2150 Scientific Communication Course generally taken in year 2 of the program. This section will be reviewed by the committee and feedback given during the exam period. Exceptions to this rule can be made by the Computational Biology DGS(s) in special circumstances.

The chair of the thesis committee is required to submit a [Comp Bio Qual Exam feedback form](#) of the qualifying exam with the computational biology program coordinator within two weeks of the exam.

12. ADVANCING TO CANDIDACY:

Advancing to candidacy will be conditioned on positive outcomes in the student's coursework, laboratory rotations, research presentations and qualifying examination. Once a student has advanced to candidacy, they are expected to meet with their thesis committee no less often than annually. No formal reports are required of these meetings, but will be addressed with Advisors at annual December Ph.D. review meetings.

Upon advancing to candidacy, no transitional master's degree is offered by the Computational Biology Ph.D. program. If you have questions regarding this, please contact the CCMB Director.

13. GRADUATION:

Candidates approaching completion of their thesis must schedule a full committee meeting at least 3 months before they intend to defend their thesis. At that meeting, the candidate and committee should identify a convenient date for the defense, and the committee must agree that the candidate is on track to complete their thesis in the remaining time leading up to the defense. Any expectations for research to be completed must be articulated in writing by the committee to the student, and circulated to the DGS(s) and Center Manager.

The defense will take 3 hours, consisting of a one hour public presentation and a 2 hour closed door defense with the thesis committee. Students can work with the program



administrators to schedule a suitable space for the public seminar as well as go through the checklists on the Graduate School website to submit the proper paperwork and forms.

The complete dissertation must be submitted to all committee members and the Center Manager at least two weeks before the scheduled defense date. This document should be compiled into a single PDF and include:

- Title Page (do not number)
- Abstract for the whole dissertation
- Acknowledgements (if desired)
- Table of Contents
- Introductory Chapter describing the overall idea of the thesis and the connections between the chapters and the broader field.
- Research chapters, each with its own title, abstract and bibliography.

There is required formatting from the Brown Graduate School for the final version, and instructions for that formatting may be found on the Graduate School website. The document presented to the committee does not have to conform to Graduate School formatting, but students are expected to produce a professional product.

The dissertation defense should be scheduled at least one month before the graduate school deadline for thesis submission to allow revision requests from the committee and evaluation of those revisions. The University now allows graduate degrees to be conferred in October and February for those students who complete their requirements after the May Commencement exercises. Commencement exercises will still only take place on the Sunday before Memorial Day for those who wish to participate. Due to these additional dates the Graduate School will no longer allow extensions to the May 1st deadline for filing dissertations. The following links contain the relevant information.

- [Student information on the Application to Graduate](#)
- [Additional required steps from the Graduate School](#)

As scientists, students are becoming professional writers. The coin of the realm is published papers, and it is expected that chapters from the dissertation will appear as published papers in peer-reviewed journals. At least one chapter must have been submitted for publication prior to graduation unless the committee expressly agrees to a deviation from this standard. In any case, all chapters should be written with publication in mind. For all submissions to journals before the dissertation defense, students are required to seek feedback from the committee before submission. Students are encouraged to be proactive and to work closely with their advisors and thesis committee in devising a strategy for publishing thesis research before or after graduation.

14. ADDITIONAL REQUIREMENTS AND DETAILS:

The items below are important parts of the Computational Biology graduate experience and/or resources all graduate students should be aware of, listed in no particular order.



Seminars

Prior to admission to candidacy, all Ph.D. students are expected to attend the majority of CCMB-hosted seminars in the joint seminar series. Students are also expected to organize and participate in student-run colloquia, such as their home department's seminar series and/or data club. The CCMB also has a Journal Club and a Math/Stats club which count toward the seminar requirements.

Brown University Individual Development Plan (IDP) policy

All graduate students are required to prepare and submit Individual Development Plans (IDP) by the end of the first semester, following the guidelines and template provided [here](#). The contents of this document are used in lieu of writing annual reports. Students should submit draft versions of their IDP to their mentor(s) for discussion regarding their progress. The student should then finalize the IDP and submit the final responses of their IDP to the Google form for the CCMB administration to share with the Ph.D. review committee.

Mandatory Research Trainings

Federal, RI State and Brown University regulations require that all laboratory researchers receive training in laboratory safety, hazardous waste disposal. All first-year graduate students are also required to take (and pass) the BioMed Responsible Conduct of Research Course. Students who fail the course will have to take it again in the second year. Other training that may be required, depending on your research and its funding sources, animal care and use, human research protections, biosafety, x-ray safety, and formaldehyde exposure control. Please ask your advisor or other members of the research group to determine which trainings are required for you. New students are advised to complete safety training before the start of classes, so arriving on campus in August is recommended.

Financial Support

As detailed in the admission letters, Ph.D. students are guaranteed five years of financial support. The Graduate School also provides \$1,200 transitional stipend for incoming doctoral students. The stipend aims to help offset moving and other costs associated with relocating to Providence and beginning Graduate School. Doctoral students receive their first monthly stipend payments at the end of September. Incoming students needing financial support in advance of September are eligible to apply for a [short-term loan](#) as of August 1 of \$500.

In addition, all Computational Biology Ph.D. students are given the option to receive a Brown University issued laptop configured to specifications deemed necessary for research and coursework. Laptops are tracked and eligible for replacement every 3 years provided the prior issued laptop is returned.

While stipend, tuition, and health insurance are guaranteed provided the student is making appropriate progress, grant writing is essential for doing science. Thus the Computational Biology program urges all students to apply for any and all graduate fellowships for which they may be eligible. The process of applying can help with the clarification of research ideas, hone writing skills, and provide training in balancing research, teaching, studying and



grant writing – a critical set of survival skills.

In addition, all eligible students not already supported by the NSF Graduate Research Fellowship are expected to apply for this fellowship in their second year.

Below are links to several Fellowships, most of which have deadlines in early November, and more can be found on the CCMB Ph.D. program's "[Helpful Links](#)" page.

NSF Graduate Research Fellowship
<http://www.nsfgrfp.org/>

Howard Hughes Medical Institute Fellowships
<http://www.hhmi.org/grants/office/graduate/>

NIH NRSA Individual Predoctoral Fellowships
<http://grants.nih.gov/training/nrsa.htm>

Department of Energy
<http://orise.orau.gov/doescholars/>

Department of Defense
<https://www.asee.org/ndseg/instructions.cfm>

National Academies Fellowship
<http://www7.nationalacademies.org/FELLOWSHIPS/>

Proposals for some small grants, such as the Sigma Xi Grants-in-Aid, can be submitted directly by the student to the granting organization. Others must be submitted through the BioMed Research Administration (BMRA) and the Brown Office of Sponsored Projects (OSP). It is critical to find out as soon as possible whether a proposal must go through these channels because BMRA and OSP require a full six business days lead time on proposal submission. This policy is strictly enforced and can be somewhat confusing when university holidays might be involved. It is a good idea to contact the Computational Biology Administration as soon as you know that you plan to submit a proposal, and at least a month in advance. Some postdoctoral proposals have to be submitted through the equivalent offices at the host university, so advance planning and good communication with your potential postdoc advisor are particularly important for postdoc proposals.

Career Development

Scientific meetings. Students should attend a scientific meeting in their chosen field in each year of their program. Financial assistance from the [Division of Biology and Medicine](#) or the [Graduate School](#) is available.

Research travel. Students can receive financial assistance for research and conference travel from the [Brown Graduate Student Council](#) as well as the [BioMed Department](#)



and the [Medical School](#) depending on the student's home department affiliation.

Once funding from the above sources have been exhausted, Comp Bio students are eligible for up to \$750 in funds to cover the remaining costs of their travel per year. Additional funding requests will be considered on an ad-hoc basis by the CCMB Manager and Director.

Postdoctoral and professional positions. The final goal of this graduate program is to place its graduates in competitive positions that enable them to reach their career goals. Students should begin considering potential postdoctoral positions during the 4th year of their program. The primary advisor and Thesis Committee are the best source of suggestions, as this is usually a matter of fit between past training and future interests. Potential postdoctoral advisors may not have funds to support fellows, so plan on writing a Postdoctoral Fellowship. These applications can take a significant block of time to prepare (1-2 months), and this should be done well in advance of completing the dissertation so that a lag in funding can be avoided.

Student Psychological Support

It is very common for students to occasionally encounter interpersonal or psychological challenges during their tenure in graduate school, and a number of resources are available to provide support in this event. Each of the following individuals will be happy to speak confidentially with students on any matter, subject only to Title IX restrictions, detailed below.

- Computational Biology Directors of Graduate Study
- BioMed Associate Dean for Graduate and Postdoctoral Studies
- The Graduate School Associate Dean for Student Support

Title IX Policy: Title IX is a Federal regulation that states in part “No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.” Brown University has a well-developed policy and process for enforcement of this regulation. If you choose to tell any faculty or graduate TA of yours about an incident of gender-based violence, including sexual assault, dating violence, stalking, or harassment that you experienced as a student, they are required to direct any information you disclose to the Title IX Office. Please keep this in mind when deciding whether and how much information you share. If you would rather speak to a confidential resource about a Title IX issue, the following services are available to you on campus: CAPS (401-863-3476); SHARE Advocates (401-863-2794); Chaplains (401-863-2344).

Grievances

If at any time you have concerns about your progress in the program, the relationship between yourself and your advisor or in fact just need to talk to someone about your experience in the program our Center Manager and DGS(s) are committed to providing support and information about any and all resources that are available to our students. If you



Brown University
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are not comfortable approaching either of these individuals, please be aware of the [Graduate Student Grievance Procedures](#), information about which is found on the Graduate School website.

University Ombudsperson:

The Ombuds Office provides an [independent](#), [confidential](#), [neutral](#) and [informal](#) resource for faculty, staff, postdoctoral fellows and associates, graduate students and medical students who have concerns arising from or affecting their work and studies at Brown.

Meetings are by appointment only to protect visitor's privacy. More information is available on the linked website.