Cornell University

Graduate Field of Biochemistry, Molecular and Cell Biology

Blue Book

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PREFACE

This manual is intended to be useful for both students and faculty in the Field of BMCB as a source of information on Field policies. In putting it together, we have drawn heavily on a similar manual for the Field of Genetics, Genomics and Development, most recently assembled by Eric Alani and Paul Soloway. We thank them for their efforts.

If you have corrections or suggestions for changes, please email them to Vic Shaff (ves3@cornell.edu), Casey Moore (kathleen.moore@cornell.edu) or Ginger Tomassini (glt38@cornell.edu).

TABLE OF CONTENTS

PROGRAM OVERVIEW

Viewed broadly, the research focus of the Graduate Field of Biochemistry, Molecular and Cell Biology is to uncover the fundamental chemical, biochemical, molecular biological, and cell biological principles that govern all forms of life. One hallmark of the Field of BMCB is its breadth of research areas and its interdisciplinary approach. A second hallmark of BMCB is the many productive interactions and collaborations across the entire spectrum represented by the Field. Cutting edge technologies in genomic, computational, structural and imaging, and nanobiotechnology are employed to study the fundamental processes such as: mitosis and membrane trafficking, transcriptional regulation and DNA replication, macromolecular machines and physiological responses in whole animals. The Field of BMCBs is one of the largest graduate programs in the biological sciences at Cornell University, and has enjoyed continuous support from the National Institutes of Health for over 40 years through its pre-doctoral student Training Grant in Cellular and Molecular Biology (CMB). The Field has a long tradition of providing a nurturing and supportive environment for the successful training of graduate students.

GRADUATE PROGRAM

REGISTRATION

All students must register at the beginning of each term including summer unless he or she withdraws, is granted a leave of absence, or completes the degree. Course enrollment can be completed any time during the first three weeks of classes, but should be done as soon as possible. Talk with your major professor, the Director of Graduate Studies (DGS), and committee about what courses to enroll in. Before you register each term, your bursar's bill should acknowledge the receipt of your financial assistance. If not, check with a Field Assistant (107 Biotech Building) to rectify the situation.

You must also register for the **summer semester** by the end of May. This is necessary if you plan to use university facilities such as libraries, computer centers, and the Gannett Health Center. Note that you cannot receive a paycheck unless you are registered for the summer semester. If you register after May 31, FICA taxes will be withdrawn from your paycheck. You can now register for the summer on line at the Graduate School web site: www.gradschool.cornell.edu.

SPECIAL COMMITTEES

One of the most important decisions you will make as a graduate student at Cornell is the selection of your Special Committee. The progress of each graduate student is guided and supervised by the Special Committee, which consists of the thesis research supervisor (the Chairperson of your committee and your major professor), a faculty member representing a minor subject (chosen by the student; see below), and another faculty member from the Field of BMCB. Occasionally, students include an extra faculty member on their Special Committee for additional expertise. Students should identify a Special Committee Chair (research mentor) at the end of the first academic year (or during the summer, if further rotations are required, August 15 at the very latest). A full Special Committee should be assembled by the end of the third semester of registration , but students are encouraged to begin seeking the advice of possible members earlier, since much of the student's coursework is taken during the first year. The DGS serves as your Chairperson and adviser until you choose a Special Committee.

The Special Committee system offers great flexibility to the Ph.D. program since it permits tailoring of the program to your specific interests. We encourage you to talk to other graduate students and faculty and to seek as much information as possible before selecting your committee members. Make an appointment to meet with each of your potential committee members and bring relevant materials to the meeting (e.g., curriculum vitae, course records, and summary of research plans if possible). Be prepared to discuss why he or she would be an appropriate committee member. It is important that you both understand each other's expectations: what courses will they require, what assistance they can provide for certain experiments, etc.

As your research program develops, don't panic if you realize that someone else might be more appropriate. Until your third semester, you can request Committee formation and change on-line in your Student Information Center (studentcenter.cornell.edu). After your third semester or enrollment or your A-Exam, you must ask the Graduate School for a paper copy of the form. (Changing your Committee after your A-exam also requires a general petition to the Graduate School to approve the requested change. All of your new Committee members must avow, in writing, that they accept the results of your A-Exam.)

You are required to meet with your entire committee at least once a year to discuss progress and plans (see ANNUAL PROGRESS REPORT). It is the student's responsibility to arrange the meeting. This meeting should take place as soon as possible after your Monday seminar, and **certainly within two weeks of the seminar**. Regular meetings with the full committee (a minimum of once a year) will help keep your program on track and can help avoid those awful moments at your defense when a committee member asks why you did not do this control or that experiment. You can also meet with them individually along the way. Use your committee for guidance and feedback. That's why they are there.

REQUIRED COURSEWORK IN THE MAJOR

All courses taken to fulfill requirements should be taken for a letter grade unless S/U is the only option.

CORE TRAINING

Laboratory research (first year):
BIOMG 8310 Advanced Biochemical Methods I - Lab 01 (weeks 1-7) (Pleiss et al; fall) – 1st yr
BIOMG 8310 Advanced Biochemical Methods I - Lab 02 (weeks 8-14) (staff; 1st rotation; fall) – 1st yr
BIOMG 8320 Advanced Biochemical Methods II (staff; 2nd and 3rd rotations; spring) – 1st yr
* Please note that there is apparently a long break between the first and second semesters in the official academic calendar. However, graduate students are expected to be working on their first or second rotation (see Laboratory Rotations) during the intersession period.

Foundational knowledge and critical reading of the literature (first year):
BIOMG 8369 Foundations and Frontiers in Cell and Mol. Biol. (Lee; 2cr, fall) – 1st yr
BIOMG 8370 Foundations and Frontiers in Cell and Mol. Biol. (Smolka/Grimson; 4cr, spring) – 1st yr

Quantitative skills: at least one quantitative methods course (first or second year):
BTRY 6010 Statistical Methods I (4 credits Fall) -1st yr or 2nd yr; OR
BTRY 6020 Statistical Methods I (4 credits Spring) -1st yr or 2nd yr

Written communication / Grant writing skills (first year):
BIOMG 7940 Proposal writing course (Brown; 1cr, fall) -1st yr

FOCUSED TRAINING

Elect 2 courses
BIOMG 6310 Protein Structure, Dynamics, and Function (Nicholson; 3cr, fall)
BIOMG 6330 Biosynthesis of Macromolecules (Roberts/Wilson; 2cr, fall)
BIOMG 6360 Functional Organization of Eukaryotic Cells (Hu; 2cr, spring)
BIOMG 6390 The Nucleus (Lis; 2cr, spring)
BIOMG 6870 Tricks of the Trade: How to use Genetics to Dissect Cells, Molecules, and Developmental Pathways (Wolfner/Goldberg; 3cr, Spring, since this course is offered every two years, students may take it in the first or second year)

ADDITIONAL REQUIRED COURSES

SECOND YEAR STUDENTS
BIOMG 7510 Ethical Issues and Professional Responsibilities (Hanson; spring)
BIOMG 8330 Research Seminar in Biochemistry (Emr; 1cr, fall/spring)
BIOMG 8300 Friday afternoon BMCB/GGD seminar
BIOMG 8380 Scientific Communication in BMCB (Instructor TBD; 1 cr, spring)

THIRD AND FOURTH YEAR STUDENTS
BIOMG 8330 Research Seminar in Biochemistry (Emr; 1cr, fall/spring)
BIOMG 8300 Friday afternoon BMCB/GD seminar

FIRST – FIFTH YEAR STUDENTS
Career development: students are required to take one **Careers course** before graduation, but are encouraged to participate in more.

ACADEMIC STANDARDS: For courses with a letter grade, students are expected to receive a "B" (3.0) or better in order to remain in good standing in the program. If a student receives a C+ or lower grade in any core BMCB course, no credit is given for that course, implying that the course must be retaken if it is a required course. If a student receives a grade below B- in two or more classes, he/she will be asked to leave the program (see First Year Evaluation below).

Mandatory Responsible Conduct of Research (RCR) Training

The integrity of research conducted at Cornell University is of the utmost importance to the institution as well as to our research sponsors. Cornell is committed to promoting and supporting the ethical and responsible conduct of research across all disciplines so that our researchers are provided an environment in which they may continue to conduct preeminent research, maintain the public's trust in the excellence of our research, and prepare current and future generations to similarly contribute to research discoveries that will address and advance national and global needs. As a result, **all students are required to take the on-line RCR training in their first year of studies.** For more information and to access the training, go to http://www.oria.cornell.edu/rcr/index.html.

In addition, all students are required to participate twice in the Annual RCR Symposium, offered in January of each year. Further, each student must participate in lab group meetings where RCR is discussed once a year and report the date of that meeting on their annual progress report.

CHOOSING A MINOR

Students are required to designate at least one minor. When you submit your Special Committee request, you will be asked to identify the "major" and "minor" that each member of your committee represents. One practical impact is that your designated "major" & "minor" will be listed on your transcript.

To help you choose a minor subject, the Graduate School publishes a list of major and minor subjects and concentrations for all graduate fields at Cornell https://www.gradschool.cornell.edu/academics/fields-of-study/fields). Note that if a faculty member in BMCB is also a member of a field that you choose as a minor, you may choose that faculty member to represent the minor if you wish.

You can pick any areas of study listed as your "minor". For example, as a BMCB student, you could select "Biochemistry" as the "major", and select "Molecular Biology" as the minor (usually your PI represents the "major", the other committee members could represent the same "minor" or different "minors", OR one of them represent the "minor", whereas the other simply represents the "major" that your PI also represents). You could pick a minor that is right in the area of BMCB (example above), OR a minor that is more distantly related, depending on your interest / relevance to your research. **"Minor" provides the student with an opportunity to delve with greater breadth and depth into a specific area. Students minoring outside of BMCB generally take an additional two courses to fulfill the**

minor requirement, which should be chosen in conjunction with their minor advisor to best suit their overall goals.

[A note on your transcript: Obviously, for your PhD degree, your research trumps any coursework you could possibly take. Depending on your future career goals, your transcript may or may not be very important. If you consider an alternate career, your future employees (or law school, business school) might want to see your transcripts. Some predoctoral and postdoctoral fellowship applications will need you to submit your transcripts. In general, if you go with a more traditional academic track of postdoctoral training / research, then your publications are far more important than your transcripts.]

Most minors typically chosen by BMCB graduate students require a couple of additional courses, which students are strongly encouraged to finish by the end of the second year. Fields often have guidelines, rather than strict requirements, for the number of courses needed to satisfy a minor. It is up to the faculty member who represents the minor to decide, in consultation with the student, how many courses and which courses are to be taken. You should discuss with potential committee members which courses they would want you to take, given your background and interests.

BMCB Minor Requirement for Students Majoring in a Field Other than BMCB

For Ph.D. candidates with a minor in BMCB, the suggested requirements are at least six credits of advanced lecture courses (usually at the 6000-level, but some 4000-level courses may be appropriate, e.g., BIOMG 4370, BIOMG 4380, BIOMG 4450. Appropriate courses in BMCB include: BIOMG 6310, 6330, 6360, and 6390. 6000- and 7000-level courses in other departments, i.e., Chemistry & Chemical Biology, Plant Biology, Vet Molecular Medicine, and Vet Microbiology & Immunology, may also be suitable, as determined by the Special Committee. If a student who wants to minor in BMCB has not been exposed to appropriate lab work in the general area of BMCB, then he/she should also take the lab course BIOMG 4400.

For MS candidates with a minor in BMCB, the suggested requirements are at least four credits of advanced lecture courses (and a lab if appropriate). Some suggestions for appropriate courses are indicated directly above.

Note that requirements are determined by Special Committees, and that the recommendations above are guidelines offered by the Field.

LABORATORY ROTATIONS

Rotations provide an opportunity to explore areas for possible Ph.D. thesis research. In addition, both students and faculty are able to test possible working relationships. Students are required to complete three rotations during their first year in the program. Occasional exception can be made for a student who has extensive previous research experience. If you think your previous experience merits a waiver of a rotation, discuss the possibility with the DGS. **All first year students are expected to have been accepted into a lab by August 15, i.e. by one year after they have enrolled. Rotations cannot continue after that time; failure to identify a research lab prior to the beginning of the second year of matriculation will likely lead to the student being asked to withdraw from the program.**

Recommended Timing for Rotation Periods

First Period: mid-October – mid-December
Second Period: early January – early March
Third Period: early March – early May

* Please note that there is apparently a long break between the first and second semesters in the official academic calendar. However, graduate students are expected to be working on their first or second rotation during the intersession period.

Each rotation should be ~8 weeks in length. The exact timing is flexible and can be worked out between the faculty and student; the GFAs should be kept informed of the location and timing of each rotation.

During the first half of the Fall semester BMCB students meet as a group twice a week to hear each of the faculty in the Field discuss his/her research. These meetings are called "Rotation Talks." Detailed information on Field faculty is available on the web site: www.bmcb.cornell.edu. All first year students are expected to attend these talks. Except under special circumstances, all three rotations should be carried out with members of the Field of BMCB. To arrange for laboratory rotations, students should discuss with individual faculty and arrange to rotate in the interested lab at a mutually agreed-upon time.

Usually by the end of the third rotation, you should have discussed with your rotation faculty about the possibility of joining the laboratory for your thesis research. Please note in general faculty are not supposed to commit to accepting a student into his/her lab for thesis research until the last day of classes in Spring semester (usually early May). This is designed to ensure all students have the fair chance of completing their third rotation periods, before faculty make their final decisions. However, students are encouraged to have clear and honest discussion with interested faculty about the possibility of joining their labs ahead of time, so as to gauge the likelihood of joining a particular lab, and whether a summer rotation will be necessary. Students who want to initiate a fourth rotation in the summer months should consult with the DGS.

What is expected of a graduate student on rotation? While no one objects to a graduate student completing a project and writing a paper for publication during a rotation, no one expects it either! What is expected is self-motivated earnest effort, independent thinking, and the fullest participation possible in the intellectual life of the laboratory, culminating in a written description and/or oral presentation of the project and record of the progress made.

FIRST YEAR EVALUATION

The supervising faculty is required to meet with the student to discuss his/her rotation performance at the end of each rotation period and a Rotation Evaluation Form (see Appendix II) must be filled out by the faculty and turned into the GFAs.
At the end of the 1st year, the BMCB Advisory Committee will meet and evaluate each 1st year student. Their recommendations will be discussed by the entire BMCB Field faculty at the annual field meeting. Anyone who is judged not to have made satisfactory progress is asked to leave the program.

In the absence of persuasive mitigating circumstances, students with the following performance in their first two semesters will be asked to leave the BMCB program:
*Two or more 'failed' rotations
OR *Two C grades in core courses
OR *One C grade in core courses AND one failed rotation
OR *Cumulative GPA < 3.0 in core courses AND one failed rotation**
Students are also expected to take a minimal of 4 credits of GRADED courses each semester during their 1st year in the program.
Students who have been unsuccessful in identifying a faculty mentor (Special Committee Chair)

TEACHING

All graduate students in the Field of BMCB are required to participate in teaching. The minimum requirement is for each student to be a teaching assistant (TA) for **one** semester. Many BMCB students prefer to do two rather than only one semester of TAing, either because they would like more teaching experience or because student costs are then paid by the department who offers the TA position. Most students will be asked to teach during the fall and/or spring term of their second year, but students will teach in their third or later years. Most students will TA for a MBG course, but TA positions from other departments will equally fulfill the TA requirement of BMCB.

For a TA position at MBG, see the following guidelines:

The summer before teaching begins, students receive from the Associate Chairman of MBG (who makes the TA assignments) a list of courses that are given in the Department of MBG, and a list of the responsibilities of TAs in each course. Each student ranks the courses in order of TA preference. While the Assoc Chair tries to accommodate these preferences for teaching assignments, the teaching needs of the department take precedence over individual preferences.

Preference in TA assignment:
1. A student whose thesis research advisor is a member of the Department of Molecular Biology and Genetics
2. A student in the Field of GGD or BMCB who has not TAed previously.
3. Any other student.

Exceptions will be made for pedagogical reasons. For example, if no student in the highest priority category is willing or able to TA a particular course, a student from a lower priority category will be chosen.

The University requires international students to have an interview by the International TA Development Program (ITADP) to assess competency in English prior to TAing. (Only students who receive a 28 or above on the Speaking portion of the TOEFL are exempt from assessment.). These interviews usually take place during Orientation. In some cases, students from non-English speaking countries are required to take an additional course, given by the ITADP, during their second year to improve teaching skills. Occasionally, students may also be required by the ITADP to take an English-as-second language course.

Teaching offers an opportunity both to extend one's knowledge and to develop communication skills. The teaching performance of each student will be evaluated by the instructor in charge of the course and copies of that evaluation will be sent to the student, the DGS, and the student's major professor. In addition, students are urged to provide a written critique of their teaching experience, and of the course in which they served, written with the intention of helping to improve the course.

Each year, the Field of BMCB acknowledges outstanding teaching efforts by presenting TA awards. One award is given through the College of Agriculture and Life Sciences (CALS). Another award is given directly by the Dept. of MBG as the Joe and Rita Calvo Teaching Award.

MONDAY GRADUATE STUDENT SEMINARS (BIOMG 8330)

These seminars are held at 12:30 pm every Monday in Rm 226 Weill Hall. All graduate students in their 2nd, 3rd, and 4th year must register for this course (BioMG 8330, S/U, 1 credit). Older students do not register for this course. However, **all graduate students must give a yearly seminar to present their research progress, starting in the second year**. Students will be exempt from this requirement only if they are officially scheduled to graduate during the semester that they would normally present a seminar (in that case, the student should contact the DGS to request the exemption). Senior students present first, starting at the beginning of the fall semester (students in their 6th year and beyond present at the end of the spring semester so they can be dropped easily if they schedule their "B" exam). If a student would like to change his/her seminar date, it is his/her responsibility to find someone to exchange places with and advise the GFA's of the change to the schedule. All 2nd, 3rd, and 4th year students are required to attend at least 2/3 of the seminars (averaged for the two semesters) in order to receive a passing grade. (Second year students who have a TA conflict, and occasionally other students with conflicts, as determined by the DGS, are exempted from this requirement). Students in their 5th year and beyond are not required to attend the seminars and DO NOT register for the course, even though they are required to make a presentation. First year students are encouraged to attend these seminars to gain perspective on the scope of research going on in the Field and to help them choose a lab in which to work.

At least 10 days before your seminar, email your seminar title and a one paragraph abstract, including a recent reference or two, to the GFAs (bmcb@cornell.edu). They will prepare a flyer to advertise your seminar.

You should remind your committee members a week beforehand about your seminar and again the Monday morning of the seminar. You may also wish to designate a faculty member outside your committee who will meet with you after the seminar specifically to critique the presentation itself. In addition, it is advisable to invite some other faculty who you think may give you some additional feedback on your work. If you extend them a personal invitation, they will likely attend.

More information and some useful guidelines for preparing and giving seminars are in Appendix I.

OTHER SEMINARS

The Friday MBG Seminar is held at 4:00-5:00pm every Friday during the Fall and Spring semesters, and occasionally during the Summer, in the G10 Biotechnology Building Conference Room. All second through fourth year students are expected to attend these seminars. The talks are given by scientists visiting from other institutions and provide an opportunity to hear and meet some of the most distinguished researchers in the area of biochemistry, molecular and cell biology. Speakers are usually invited and hosted by faculty members, but one or two slots every semester are reserved for student-invited speakers. The student representatives typically solicit suggestions for names for possible speakers. Students also often suggest names of speakers to their major professor. Coffee, tea and cookies are available at 3:45pm. If you are interested in talking individually with a speaker, see the host listed at the bottom of the seminar notice.

The bulletin board across from the first floor elevator in the Biotechnology Building or the BMCB web site (http://bmcb.cornell.edu/seminars/index.html) is the place to check for the times and topics of the many other related seminars on campus.

JOURNAL CLUBS

Participation is on a voluntary basis, but you are encouraged to attend the Journal Clubs in your area of interest. Below are some of the Journal Clubs that meet on a regular basis. Because they often change each semester, one or several contact names are provided. You can also check the BMCB web site (http://bmcb.cornell.edu/seminars/index.html) for more information.

- **Bacterial Genetics Journal Club** –Steve Winans, scw2@cornell.edu
- **Cell Biology Journal Clu**b-Tony Bretscher, apb5@cornell.edu
- **Cellular and Molecular Neurobiology Journal Club**-Kathie Burdick, krb3@cornell.edu
- **Cornell Vertebrate Genomics Meeting-**Charlotte Williams, cw25@cornell.edu
- **Developmental Biology Journal Club**-Kelly Liu, jl53@cornell.edu
- **Environmental Microbiology Journal Club**–Esther Angert, era23@cornell.edu
- **Eukaryotic Gene Regulation Journal Club**-John Lis, jtl10@cornell.edu
- **Molecular Evolution Journal Club**-Aquadro Laboratory
- **Neuroethology Journal Club-**Carl D. Hopkins, cdh8@cornell.edu
- **Repair, Replication & Genetic Recombination Group-**see http://www.micro.cornell.edu/r3group/
- **Reproductive Biology journal club-**John Schimenti, jcs92@cornell.edu
- **Sexual Selection Journal Club**-Mariana Wolfner, mfw5@cornell.edu
- **Virology Journal Club**-Volker Vogt, vmv1@cornell.edu

Most labs also have their own weekly lab meetings or other joint group meetings which are also attended by students doing rotations in those labs.

ANNUAL PROGRESS REPORT

As a graduate student in your second year and beyond, you are required to meet with your entire committee at least once a year to discuss progress and plans for your research project and completion of your program. You should arrange this meeting to take place immediately following your Monday seminar (or as soon after as possible thereafter). It is the student's responsibility to arrange this meeting and to provide faculty with the Student Progress Review (SPR) report. The Student Progress Review (SPR) report is due within 30 days of your Monday seminar (see suggested process below).

The annual progress report supports communication between the student and their Special Committee, helps to gauge the progress being made toward graduation and, as of 2017, is the basis of annual benchmarks toward graduation required by the Graduate School. It is used by the Field to monitor student progress, as well as such administrative purposes as award nominations and collection of assessment data for the Graduate School. The Progress Report is found on-line (see links below which can also be found on the BMCB Current Student Forms page).

Regular meetings with the full committee (a minimum of once a year) will help keep your program on track. You are also encouraged to meet with individual members of your committee along the way in order to get information and feedback on your program and research. Use your committee for guidance and feedback. That is why they are there.

Process for completion of annual Student Progress Report:

- Schedule a meeting with your Special Committee that coincides with your Field seminar. The purpose of this meeting is to discuss your seminar as well as your portion of the Student Progress Review.
- Complete the Student Section of the online Student Progress Review, save and download a draft to distribute to your entire Special Committee at least seven (7) days prior to your seminar.
- After your seminar, meet with Special Committee to discuss your progress and planning. This meeting should take place within two weeks of your seminar, if not immediately thereafter.
- After your meeting, finalize the Student Section of the SPR and submit it. Once you click submit, your progress report will be routed to your Chair so they can complete the Advisor section and submit it. The rest of your committee can also view the form, however, only your Chair electronically signs and submits it. (Note: Once you submit the SPR, you will be unable to edit it).
- Your Committee Chair should submit their portion of the online form within 30 days of your seminar.
- The Field of BMCB takes annual meetings and submission of progress reports very seriously and requires 100% compliance.

Links to the On-line Student Progress Report can be found on in the Forms on the Current Graduate Student section of the BMCB web site. (https://bmcb.cornell.edu/graduate-students/forms/)

Beyond the fourth year, all students must include a "Thesis Outline" in their annual progress reports. The Thesis Outline should be distributed to the Special Committee one week prior to the committee meeting, so it can be thoroughly discussed at the committee meeting.

The BMCB Steering Committee will discuss situations in which students appear to be making slow progress toward their degree or having other problems and these circumstances will be addressed confidentially at the BMCB Field Meeting.

CONFLICT RESOLUTION

If you have any kind of issues with your major professor that you cannot resolve by talking with him/her, OR you hesitate to approach your major advisor directly, then you should discuss the problem with your other committee members and/or with the DGS. **Keep in mind the DGS formally acts as an advocate of the students, so feel free to get in touch!** If you need further assistance, the Graduate School (Assistant Dean of Graduate Student Life) and the Office of Ombudsman are good resources (5-4321).

VACATION

You are paid on a 12-month stipend, so if you plan on being gone for a significant period of time, you must have the approval of your advisor and notify the Graduate Field Assistant of your intentions.

ADMISSION TO CANDIDACY EXAMINATION (A EXAM)

To qualify as a Ph.D. candidate, each graduate student must pass an A exam. The examiners for the A exam are the student's Special Committee and one other member of the Cornell University faculty (usually but not necessarily from the Field of BMCB) chosen by the student. This exam has both written and oral components.

Some procedural details

The A exam must be taken by **September 30 of your third year**. You must schedule your A exam and file a Schedule of Examination Form (available from the Graduate School web site at http://www.gradschool.cornell.edu/?p=11) by June 15. This form must be signed by all of the members of the Special Committee, the Director of Graduate Studies, and the GFA. If the exam is not taken by September 15, your mentor must write a formal letter of explanation to the DGS, including the time when the exam will be taken. A copy of the letter will go into your permanent file. Not having obtained sufficient data is not an acceptable reason for delaying the A exam.

Course requirements for the major (including BioMG 7510 "Ethical Issues"), and all or most for the minor, should be finished by the time of the A exam. Occasionally, the student and the Special Committee may feel an additional course is useful or important after the A exam and this may be recommended or required by the Special Committee.

You must invite a fourth faculty member to read your proposal and participate in your A-exam. This fourth member should add breadth to the committee and have expertise closely aligned with the topic of your proposal. The fourth faculty member does not need to be in the Field of BMCB and should not be listed on, or sign, the Schedule or Results of forms that are submitted to the Grad School.

** This fourth member for the purposes of the A exam is NOT on your thesis committee, but is an ad hoc member only for the purposes of the A exam. Even though they participate fully in the exam, they should NOT be listed or sign either the Schedule or Results form. This person participates only in the A exam, not the B exam and not in any other thesis committee meetings. If you list and have your fourth person sign your forms, it will lead to confusion at the grad school.

You should give a copy of the written proposal to each member of the examination committee at least **a week before** the oral exam.

Results of Exam: You must turn in the Results of Examination form to the Graduate School and the Graduate Field Assistant within 3 business days after the oral exam. This form can be downloaded from the Graduate School web site at http://www.gradschool.cornell.edu/?p=11.

The written proposal

Your proposal will describe the research you intend to accomplish as a graduate student.[1] The proposal should be well-formulated and presented in sufficient detail that it can be evaluated for its scientific merit. Include sufficient information to permit an effective review without readers having to refer to the literature. Brevity and clarity in the presentation will be considered indicative of an applicant's approach and ability to conduct a superior project. The proposal must be written following the format specified below.

1. **Abstract**. This is a summary of the proposed work, with enough of an introduction to allow someone not expert in the field to understand what is planned and to appreciate its importance. This should be on a separate page and not exceed **three vertical inches (single spaced)**.

   Sections (2) through (4) are not to exceed **10 pages (single spaced)**, <u>including</u> all tables and figures.

2. **Specific Aims.** State the specific purposes of the research proposal and the hypotheses to be tested. (Typically no more than half a page)

3. **Background and Significance.** Sketch briefly the background to the proposal. State concisely the importance of the research described in this application by relating the specific aims to field as a whole. Use this section to provide an account of any preliminary studies that might demonstrate the utility of the proposed project. (Typically about 3 pages)

4. **Research Design and Methods.** Provide an outline of (1) research design and the procedures to be used to accomplish the specific aims; (2) tentative sequence for the investigation; (3) statistical procedures by which the data will be analyzed; (4) potential experimental difficulties and alternative approaches that could achieve the desired aims. (Typically about 7 pages)

5. **Rigor, Transparency and Reproducibility:** In keeping with the need for renewed attention to this topic, an additional (approximately ½ page) section should provide information pertaining to:
   (1) Scientific premise: strengths and weakness of cited prior research that is crucial to the proposal;
   (2) Scientific rigor: robust and unbiased experimental design and analysis (e.g., appropriate statistics and measures to avoid bias);
   (3) Biological variables: consideration of relevant biological variables (in particular, sex as a biological variable in animal studies);
   (4) Authentication of key biological and/or chemical resources (e.g., cell lines).
   See https://grants.nih.gov/reproducibility/index.htm for additional detail on NIH proposal requirements in this domain.

6. **Literature Cited.** List all literature references. Each reference must include the title, names of all authors, book or journal, volume number, page numbers, and year of publication. The reference should

[1] If you would prefer to write on a topic outside of your research area, discuss this with your major advisor and the DGS first. In this case, you will need to write a thesis proposal after completion of the A exam.

be limited to relevant and current literature. While there is not a page limitation, it is important to be concise and to select only those literature references pertinent to the proposed research.

Formatting. The application must be clear, readily legible, and conform to the following NIH requirements:

1. The height of the letters must not be smaller than 10 point; Helvetica or Arial 12 point is the suggested font (Arial 11 point will barely satisfy this requirement).
2. Type density, including characters and spaces, must be no more than 15 characters per inch (cpi). For proportional spacing, the average for any representative section of text must not exceed 15 cpi;
3. No more than 6 lines of type within a vertical inch;
4. Margins, in all directions, must be at least 1/2 inch.

Applicants should check the type size using a standard device for measuring type size rather than relying on the font selected for a particular word processing/printer combination. Figures, charts, tables, figure legends, and footnotes may be smaller in size but must be readily legible.

In preparing the application, use English and avoid jargon. If terms are not universally known, spell out the term the first time it is used, with the appropriate abbreviation in parentheses. The abbreviation may be used thereafter.

NOTE: Use the single spacing formatting above to make sure that your final proposal with figures meets the requirements. Send an electronic copy in this format to all your committee members. But then print out hard copies in double space format to give to the committee, since this makes it easier for them to read and write comments.

The oral exam

The oral component is a defense of this proposal and you can expect that the majority of questions will be **directly related to your proposal and to areas that are considered off-shoots of it**. The committee will likely ask you to explain, in more detail than the written format permits, background material and experimental protocols.

New policy on PowerPoint presentations (starting January 2018): Students may prepare and present up to five PowerPoint slides (no animations) at the A-exam. Students also may prepare up to five additional supplementary data slides. The supplementary data slides may only include data that are also in the written A-exam proposal and should only be used if those experiments come up for discussion naturally during the course of the exam.

The committee will likely also ask **broadly-based questions on basic concepts, to ensure you have strong command of foundational knowledge in BMCB and your minor areas**. The committee member(s) representing the minor subject area(s) is particularly responsible to ascertain that you have achieved competency in that subject area.

In addition to the evaluation of your proposal, the A exam is the time when committee members will discuss and evaluate your **course work** as well as **your performance in the laboratory**. Please bring to the A-exam a summary of the courses you have taken and grades earned, either as hard copies to be distributed to the committee or as a projected slide.

Note that the Field recommendation is that during the exam, the mentor (thesis advisor) should not ask questions or make comments except when asked by other committee members or when clarification is needed. The intended goal is to dissuade the mentor, who may have a vested interest in the outcome of the exam, from stepping in to justify the research or the particular experimental approach being used. The student is expected to fully defend the proposal by him/herself. However, the mentor should participate fully in the discussion of the student's performance, after the student is asked to leave the room. In making this recommendation, the Field is aware that the Special Committee may run the A exam in whatever way it deems appropriate.

Tip during the exam: Students often misunderstand questions, often thinking they are more complex than intended. Rather than immediately answering the question, fist rephrase it in your own terms (e.g. 'Are you are asking whether.....'). This gives you time to understand the question and formulate an appropriate response.

Please see more advice on writing the proposal in Appendix II.

How much help can you receive in preparing your proposal?

Connecting to others in the research community is essential in competitive research and evidence of your involvement in science. A factor in evaluating your proposal is whether you have made these interconnections. Although you should seek out as much information as you can find about your topic, the major ideas should be yours, as should all the writing, of course. The following guidelines were crafted with the idea of encouraging input from others while at the same time focusing attention on your efforts.

In meeting with a faculty member about your proposal, it is expected that you will describe the general nature of the problem under investigation, the specific questions that you are proposing, and an overview of the approaches that you plan to take. In addition to comments on importance and feasibility, some faculty may provide you with factual material or with references.

Once you have written a complete proposal that contains all of the questions that you expect to pose and all of the experimental approaches you intend to follow, give your proposal to several senior graduate students or postdoctoral fellows and ask them for criticism. If they provide you with ideas that you use, give them credit for those ideas. For example, "(latter two controls suggested by Chelsea Clinton)". The criticisms should be general (e.g. "this section is awkward", "this is unclear", "why not expand this section to include related studies?"). No one but you should be doing the actual writing. Faculty members should not be asked to provide detailed feedback on the written proposal, nor should they ever offer to do so. Many mentors make a policy of not reading A-exam proposals at all before the exam. Other mentors will quickly (maybe in 10 or 15 minutes) scan proposals of their students in an early draft form, and offer some general suggestions, which is acceptable if it is done only once. For example, the mentor may offer the following types of comments: (1) the specific aims are too few, too many, or inadequate; (2) the methods are too detailed or not detailed enough; (3) sections on pitfalls and alternative approaches should expanded; or (4) more figures should be added or some figures should be deleted.

Possible outcomes

Some possible outcomes of the A exam are described below. While one of these outcomes will apply in most cases, it should be noted that the **final outcome is determined by the Special Committee** and they are not limited to the examples given below. Some factors that may be judged in evaluation of the A-exam are:

- importance of the problem chosen
- demonstrating a command of the field.
- evidence of creativity in formulating experimental approaches
- feasibility of the proposed experiments
- whether a range of different approaches are brought to bear on the problem
- whether the scope of the proposed experiments is feasible for a 3-4 year project
- adequacy of control experiments
- clarity of the proposal
- ability to deal with questions
- communication / presentation skills
- breadth of knowledge

1. **Unqualified pass.**

2. **Conditional Pass.** This option will be exercised when the committee judges that some aspect of the proposal / defense needs to be improved. In this case, the committee will specify the "condition" that must be reached, before the student can receive a pass.

   Some options for Conditional Pass:

   (a) The committee may specify that the entire proposal or that parts of it need to be revised within a certain time frame. *The extent to which the major professor wants to be involved in the rewriting is up to him/her.*
   Some reasons for revision are:
   - The writing needs to be improved (for example, grammar, clarity, or logical flow of ideas).
   - Some aspect of the science needs to be rethought (for example, better controls, more cautious interpretation, or more detailed description).
   - An additional section needs to be incorporated into the proposal.

   The student is expected to rewrite the proposal within 2 weeks and resubmit it to the examination committee members for approval.
   (b) The committee may specify that the student carry out additional literature review, e.g. weekly written report of a paper, participation in existing journal clubs. This might be particularly helpful when the student appears to have weak command of the literature surrounding an area
   (c) The committee may specify that the student complete a piece of research / a particular subaim within a certain time-frame. This is particularly relevant when the committee has some concerns about the ability and/or motivation of the student to complete the PhD program.
   (d) Any other options that the committee deems to be helpful for the further training of the student.

3. **Fail.** The student can fail the exam because either the written proposal or the oral defense is judged inadequate. In that case, the committee will usually recommend one of two actions. **If the committee has confidence in the overall ability of the student to complete the Ph.D. program, then they may recommend that the student retake the A exam.** In this case, they will specify whether an entirely

new proposal on a different topic is to be written or whether they expect a major rewriting of the original proposal. Note that the rules of the Graduate School specify that a second A exam cannot be scheduled earlier than 3 months after the first.

If the committee has serious concern about the motivation or ability of the student to complete the Ph.D. program, it could recommend that the student complete a piece of research, write a Masters-level thesis based on that work, and then defend that thesis. If the student wants to continue for a Ph.D. degree, and his or her committee judges that the Masters-level work and thesis defense demonstrates qualification, then the thesis defense may be accepted in lieu of an A exam. In some cases, the Special Committee may specify that reentering the Ph.D. program requires retaking the A exam.

Typically a few students in each class fail the A-exam on the first try. If you are one of these, don't take it as the end of the world. If your committee approves, just knuckle down and gear up for a re-take in three months. There are plenty of students who easily passed on the second try and who did very well afterwards.

What can I do to ensure that I pass my A exam?
We have three suggestions:

1. Read several proposals written by former students. Copies of these can be obtained from the Graduate Field Assistant.
2. Read carefully the specifics on writing the proposal.
3. If you are worried about being nervous, and having to think on your feet while being nervous, it may help you to have a practice run. You can do this by asking several students to read your proposal and then act as examiners during a mock 2-hour exam.

Remember everyone in this field wants you to succeed.

THESIS & B-EXAM

Defending a thesis successfully **requires at a minimum that the student has obtained sufficient data to make a significant contribution to at least one research paper that has been submitted or published in a peer-reviewed journal.** If the expectations are not met, the thesis advisor, with help from the thesis committee, must determine that circumstances beyond the student's control that prevented the student from meeting these expectations.

At least 7 days before the examination be sure to bring to the GFAs a completed Schedule of Final Examination form (signed by your committee members and the DGS).

THESIS FORMAT

It is instructive to quote here the advice that appears on the cover of the Graduate School publication, "Thesis and Advanced Degree Requirements": "It is the responsibility of the candidate to become familiar with the various requirements that apply and to satisfy them in the proper way." The Graduate School presents seminars to advise students writing theses and dissertations. These meetings are well advertised and offer the opportunity to obtain authoritative answers to questions about your thesis, registration, fees, commencement, etc.

Theses may be organized either as a single work (traditional thesis) or as a series of relatively independent chapters (independent chapter thesis). In the latter case, there may be a unified introduction and bibliography or separate introductions and bibliographies. There may be a unified summary, or the two-page abstract (required of all theses) can serve as a summary statement for all chapters. Some examples of thesis formats are shown below.

<u>Traditional Thesis</u>
Literature Review
Material and Methods
Results
Discussion
Conclusions
Literature Cited
Appendices

<u>Independent Chapter Thesis</u>
Chapter 1: General Introduction and Literature Review
Chapter 2:

- Introduction
- Materials & Methods
- Results
- Discussion
- Literature Cited

Chapter 3: (as above)
Final Chapter including:

- General discussion
- Speculation and
- Conclusions
- Appendices

The independent chapter option allows you to prepare your thesis as a series of papers in a format ready for publication, and chapters can be published before the thesis defense. If your published work includes co-author(s), you may cite the work of your co-author(s) in your thesis with appropriate acknowledgment, but you should not include the data of your co-author(s) in your thesis. An exception could be if data from a co-author are needed for clarity. In that case, the legend to the figure should explain this. The work in your thesis must be primarily, if not entirely, your own. You should acknowledge in the publication that the research is part of a thesis, and the Graduate School requires written permission from the publisher to include it in your thesis.

Located on the ground floor of the Biotechnology Building, Room G09 (formerly the Elizabeth Keller Reading Room) contains a collection of theses completed by graduates in the Fields of Genetics, Genomics and Development and Biochemistry, Molecular and Cell Biology. If you wish to access this room, please stop by 107 Biotech and sign out the key. Note that materials are **NEVER** to be taken from this room. Full collections of dissertations are maintained in Mann Library.

FINAL THESIS SEMINAR

The final thesis seminar usually is given immediately before or on the same day as the thesis defense, i.e. the "B" exam. However, in some cases students may want to present the thesis seminar up to six months before the B exam, in order to allow input from the special committee about final experiments.

THESIS DEFENSE ("B") EXAM

To schedule the oral defense of the Ph.D. thesis (or "B" exam): At least seven days before the exam you must

- distribute the thesis to the Special Committee,
- present the completed Scheudle of Exam form with signatures of your entire Special Committee and the DGS to the GFAs along with the title and abstract for the thesis seminar, and a publication list including all manuscripts you have published / submitted / in preparation.

MASTER'S DEGREE

The Field of BMCB does not have a formal Master's degree program. PhD students may, in certain circumstances, wish to change their degree program to the Master's of Science (MS). Sometimes this is the result of a change in the individual goals of the student. Other times, it may be at the recommendation of the student's Special Committee. The student should consult with their Special Committee and the DGS to discuss this possibility prior to making a formal request to the Graduate School via the Change of Program form. The Graduate School will pass this form on to the Field for approval and, if the request is approved, a new admission letter will be sent to the student.

The requirements for a Master's degree include the coursework normally taken by first-year students, at least two rotations, one semester of teaching, and a research-based thesis (including a thesis defense). At a minimum, the Special Committee of a Master's degree candidate is composed of a chairperson and a faculty member representing a minor subject. The student may invite a third faculty member to be on the committee if he or she chooses.

GRAD STUDENT LIFE

Graduate Student Representatives: At least two student representatives are selected each year from the first year class mid-way through the first year. While the DGS may coordinate this process, the students are entirely responsible for picking their reps. The same student reps continue to represent that particular class as the class move on in their program. The reps coordinate grad student help during the recruitment of new graduate students, communicate directly about curricular issues with the DGS on behalf of all BMCB grad students, and attend BMCB faculty Field meetings (except for discussions about individual students in the spring meeting).

MBG Annual Picnic is held at the beginning of the fall semester and is a good way to meet the students, staff and faculty. Information will be provided at BMCB orientation or look for flyers posted in MBG.

There is a happy hour almost every Friday afternoon after the MBG seminar, on the second floor of Biotech. Come and meet other students, faculty and staff and wind-down from the busy week.

The **Big Red Barn** is a place to socialize and meet other graduate students. You can reserve space there at no cost for professional or social activities.

The **BMCB Graduate Student Association (GSA)** organizes several social events every year.

The **Graduate & Professional Student Assembly** is an organization of graduate and professional students that are a voice for graduate student rights on campus. (https://assembly.cornell.edu/shared-governance-cornell/graduate-and-professional-student-assembly)

For a complete list of the graduate student organizations on campus, visit http://www.gradschool.cornell.edu/.

FINANCIAL INFORMATION

FIELD SUPPORT

Students making satisfactory progress receive financial support, including tuition fellowships or waivers. Senior students who would normally be supported on a research grant but find that their research group is temporarily low in funding might be asked to teach additional semesters in order to receive stipend and tuition support from the Department of MBG.

The Immigration Reform and Control Act of 1986 requires that Form I-9 be filed with the University for **ALL** graduate students. The Graduate Field Assistant will distribute and collect forms for all students. An I-9 form must be on file before a student's first check can be released. International students are also required to complete a Foreign National Questionnaire.

All stipends (assistantships **and** fellowships) are considered taxable income. State and Federal income tax is withheld from all assistantship paychecks that are processed semi-monthly through Cornell's payroll system. Fellowships are processed through the Graduate School and **taxes are not withheld**. However, these awards are taxable and students are responsible for filing a tax return and for paying taxes. Estimated taxes are paid quarterly. You must obtain the forms (local library has them and available at the IRS web site) and submit them to the IRS. You may be fined if you don't pay the estimated taxes. Tuition is not considered taxable income unless provided directly for "services rendered." Books and supplies are deductible and receipts should be kept (consult your tax advisor).

NIH TRAINING GRANT IN CELLULAR AND MOLECULAR BIOLOGY

The BMCB Graduate Program has benefitted enormously by support for over 40 years from the NIH in the form of a Training Grant in Cellular and Molecular Biology. The Program Director, presently Tony Bretscher, and Executive Committee decides how the available support, currently for 14 students, is awarded. Most or all of the slots support eligible students in their first year. However, slots may also be awarded to students in their second, or more commonly in their third year. This award is specifically to train students in the BMCB Graduate Program, and its continued support from the NIH depends on several factors, including maintaining its unique integration into the training structure of the Program.

BMCB students, including those not supported by the CMB Training Grant in their first year, generally cannot be supported by another NIH Training Grant as this could jeopardize the competitive renewal of the CMB grant. Thus, students cannot be supported from another NIH Training Grant in their first two years as this would interfere with the training provided by the Program. If support is desired from another NIH Training Grant in the third year or beyond, it is due to the need for extensive new training necessary for the research project. Therefore, BEFORE APPLYING FOR SUCH SUPPORT, THE STUDENT AND THEIR ADVISOR MUST seek permission in writing to the DGS and TG Director explaining the compelling reason for such support. If the DGS and TG Director feel that such additional support would conflict with the intent of the NIH CMB Training Grant, they can prohibit a BMCB student from applying for that support.

METHODS OF PAYMENT TO GRADUATE STUDENTS

Method A

As a Graduate Research Assistant or a Teaching Assistant a student is considered an employee of the university. Student payment is processed through the payroll system. The student is paid semi-monthly a fixed amount based on the annual stipend rate. Timecards are not required or collected. Taxes are withheld from the student check – the amount will vary depending on how the student fills out the W-4 form. The W-4 form can be changed anytime during the year. The student will receive a W-2 from the university to the address listed on your paycheck. You are strongly encouraged to use direct deposit; https://www.dfa.cornell.edu/payroll/employees/directdeposit. If you do not sign up for direct deposit, your check will be mailed to your address on Student Center.

Method B

The student is on a fellowship, either university fellowship or supported by a departmental fellowship (BCMB training grant support is considered a fellowship payment). Students are paid once per semester for fellowship support. This check is issued at the beginning of each semester of study. If you have not signed up for direct deposit, you will be able to pick up fellowship checks at the Bursar's Office in Day Hall. after registration. Taxes ARE NOT withheld from fellowship checks and you are responsible for paying estimated taxes on your taxable income. If you are supported during the summer months from a fellowship, you will receive a check in mid-June and early July. You are strongly encouraged to sign up for direct deposit. You may sign up for direct deposit from the Bursar's Office (for fellowships, Grad School travel grants, etc) at https://www.dfa.cornell.edu/bursar/students-parents/deposit-refunds.

Tuition Payments

Tuition payments are made through the PeopleSoft financial system. Fall tuition is credited by August and Spring tuition is credited by January to your bursar bill. The tuition payment should be taken care of automatically for most students. If you have questions regarding your bursar bill, please see the GFA in 107 Biotech.

Health Insurance

All registered grad students are automatically enrolled in the Student Health Insurance Plan (SHIP), an accident/illness policy that meets the health insurance standards developed by the American College Health Association. The yearly premium is paid by your source of financial support and should be taken care of automatically. Please contact the GFA if there remains a charge on your bursar bill. Additional family coverage and/or optional dental and vision insurance is available at a cost to the student. More information can be found on Gannett's Web site, www.studentinsurance.cornell.edu.

TRAVEL

Travel Grants: The **Graduate Student Travel Fund** provides money to enable full time students to present papers or posters or to perform an equivalent function at professional meetings. The maximum award is $600, but the amount of the award is based on geographic location and will not necessarily cover the full cost of the student's transportation expenses. For specific information and application materials, see https://gradschool.cornell.edu/costs-funding/travel-funding-opportunities

AWARDS

The Harry and Samuel Mann Outstanding Graduate Student Award. We ask graduate thesis advisors from the Department of Molecular Biology and Genetics to nominate outstanding BMCB graduate students who have just completed their 3rd or 4th year and will be in residence for at least one more year and have made substantial progress on their dissertation research. The nominated student must possess excellent scientific and personal communication skills and be able to present his/her research to both specialists and non-specialists, including members of the donor family. The award is in the range of $20,000 each year and can be held only once. The student may use the funding for travel to a conference, computer purchase, salary, and research supplies/equipment, as negotiated with the major professor and as approved by the Chair of the Department of Molecular Biology and Genetics.

The George P. Hess Travel Award. We ask graduate thesis advisors from the Department of Molecular Biology and Genetics to nominate outstanding BMCB graduate students who have just completed their 3rd or 4th year and will be in residence for at least one more year and have made substantial progress on their dissertation research. The student must possess excellent scientific and personal communication skills and be able to present his/her research to both specialists and non-specialists. This travel award (preferably for a national or international conference) is for $500.00 and can be held only once.

The **Fuertes Memorial Prize,** sponsored by the Cornell Chapter of Sigma Xi, is awarded for a 10-15 page essay on a scientific or technical topic presented in a popular manner that will be comprehensible to the nonscientific reader ($350 first prize, $150 second prize; deadline is usually in February — watch for announcements).

Graduate Women in Science Award for Excellence. Sponsored by the Cornell Chapter of GWIS, it is for scientific research by female graduate students at Cornell. Abstract deadlines are in early Spring. The winner is chosen from 5 finalists after they present short talks on their research at a meeting in late April. Watch for posted announcements.

The Liu Memorial Award and The Hsien Wu and Daisy Yen Wu Scholarship Endowment Fund are open to students in any field who have completed at least three semesters of graduate study. Preference will be given to graduate students beyond the second year of study who are of Chinese descent irrespective of citizenship. Previous awardees are ineligible. Awards are based on demonstrated academic ability and performance with some consideration given to character and financial need. The Director of Graduate Studies submits a nominating letter, several supporting letters from other faculty members familiar with the student, and any other information which would be helpful to the selection committee in evaluating the student. A student may be asked to compose a brief statement summarizing her/his graduate progress, career plans, etc. Only one nomination per field will be accepted. These nominations are due April 1 and awarded May 1 each year. Although the final dollar amount is decided by a selection committee, past awards have ranged from $1,000 to $3,000.

Both the College of Agriculture and Life Sciences and the Department of MBG Calvo Teaching Award each make one award annually to a graduate student for excellence in teaching in a MBG related course. The Associate Chair of MBG solicits nominations from faculty of their top teaching assistant of the past year.

The LPS Award was established by Frank Meleca, founder of the Laboratory Product Sales company, which sells a variety of products to research labs like those in BMCB. This award is given each year to a

BMCB student (and a similar award to a G&D student) who is first author on what is judged to be the "best" paper published in the previous calendar year. All BMCB grad students are eligible, including those who have finished their PhD and left Cornell. The award is $500 in cash, and the winner has his/her name engraved on a plaque in the front office. Next to the plaque is a framed list of all papers first-authored by BMCB students in that year.

OTHER IMPORTANT INFORMATION

BIOTECHNOLOGY RESOURCE CENTER (BRC) (ROOM 170, BIOTECHNOLOGY BUILDING)
http://www.biotech.cornell.edu/

The Institute of Biotechnology, one of 13 NYS Centers for Advanced Technology, operates a Core Facility in the Biotechnology Building.

The **Biotechnology Resource Center (BRC) consists of state-of-the-art integrated facilities**:
Genomics Facility
Proteomics & Mass Spectrometry Facility
Imaging Facility (including light microscopes and flow cytometry)
Bioinformatics Facility – offers useful workshops, as well as office hours.
BIO-IT Facility
Advanced Technology Assessment Facility

STATISTIC CONSULTING SERVICES
Offers very useful, free statistical consulting services – walk-in hours available as well.
Also host useful workshops.
http://www.cscu.cornell.edu/index.php

CORNELL LIBRARIES
Offer useful workshops: http://www.library.cornell.edu/svcs/serve/classinst

THESES FROM FORMER STUDENTS
Full collections are maintained in Mann Library.

CAREERS INFORMATION
Graduate School Career Development https://gradschool.cornell.edu/academic-progress/pathways-to-success/prepare-for-your-career/
Also see: http://bmcb.cornell.edu/current/career-development.html
The BMCB field also offers various career oriented seminars / workshops yearly – look out for announcements!
A collection of books focused on managing careers in the biological sciences can be found in the main office of the Biotechnology Building (Room 107). Feel free to sign these books out.
At the Bench: A Laboratory Navigator by Kathy Barker
At the Helm: A Laboratory Navigator by Kathy Barker
Academic Scientists at Work by J. Boss and S. Eckert
Making the Right Moves, organized by the HHMI and BBWF
Alternative Careers in Science, edited by Cynthia Robbins-Roth
Careers in Biotech and Pharmaceuticals by Wet Feet, Inc.

PROPER DISPOSAL OF LABORATORY WASTES

We remind all lab workers of the following policies regarding proper disposal of laboratory wastes. These policies are based on local, state, and federal laws, and are discussed in detail in Chapter 7 of the Cornell Chemical Hygiene Plan. A three ring notebook containing the Plan is in every laboratory.

Chemicals: Chemicals should not be discarded in the trash containers. This ban includes such substances as detergents. A few chemicals (e.g. sugars), securely packaged, may be disposed of directly into building dumpsters. A list of appropriate dumpster disposals may be found on p. 7.7 of the Chemical Hygiene Plan. In general, chemical wastes should be bottled, labeled, and disposed of by calling Life Safety Services at 5-8200.

A list of chemicals that can be safely disposed through the drains is given in the Chemical Hygiene Plan. If in doubt about a particular disposal, call the Office of Environmental Health (5-4862) to request advice.

Medical wastes: Syringes and other sharps must be disposed as Regulated Medical Waste in rigid, leak-proof, and puncture resistant labeled containers. Arrangements for disposal are made through Dr. Larry Thompson by calling 3-3900.

- **Labeled biohazard bags of any color or description cannot be discarded in the normal trash, regular waste dumpster, or any other waste collection device on campus regardless of content.**
- **Biohazard bags may not be placed within regular trash bags for disposal.**

Use one of the following three methods to dispose of medical wastes (other than syringes):

1) Use clear autoclavable bags without the biohazard symbol or related signage. These are available from various approved L-Order vendors such as: Krackeler Scientific (autoclavable polypropylene bags; 8-H13185-2430 [size 24"X30"@ $54.24/case of 100 bags]; Lab Products [size 22"X30"@ $54/case of 100 bags; Cole Parmer; PGC, etc.

2) Use autoclavable (reusable) buckets or bins. After autoclaving, their contents can be placed in regular plastic bags for normal trash disposal (Note: this method does not apply to syringes or sharps).

3) If you continue to use labeled biohazard bags of any color, after autoclaving they must be disposed of through Dr. Larry Thompson by calling 3-3900.

Glass: No glass should be discarded in normal garbage. Each lab is responsible for the collecting of waste glass. Waste glass boxes are available in Receiving. When the container is full and sealed, it should be placed opposite the freight elevator for disposal. It is essential that empty chemical bottles be triply rinsed before disposal.

Radioactive Materials: Any material with radioactive contamination should be discarded in the specially labeled radioactive waste container, and not in the ordinary trash container.

Be especially careful in disposing of laboratory wastes. Improper disposal may endanger the health and safety of service and maintenance personnel who handle the waste containers. Improper drain disposal may endanger our local environment.

Odor Complaints: Safe work practices in the lab will help avoid "odor complaints" from your neighbors in the building. Many complaints can be traced back to someone not following safe and approved work procedures in their lab. Things you can do to help reduce odor complaints are:

1. Use your hood when working with substances that could become the source of odor complaints.
2. Make sure that your hood is working properly. Is the sash at the correct height?

3. Dispose of chemicals properly. Do not flush down the drain substances that should be disposed of by the chemical waste pickup program. Remember that most organic solvents should not be disposed of down the drain.
4. For sinks that are not used for extended periods, periodically run water into them to insure that the traps in the drains have an adequate amount of water. The addition of two tablespoons of vegetable oil will extend this protection up to a year. This will prevent noxious volatile substances in the drains from entering your lab.

BUILDING SECURITY

The Biotechnology Building is a secure building; it is locked at before 7am and after 5:00pm Monday-Thursday, 4:00pm on Friday and at all times over the weekend. Please help keep the building secure.

1. If you see or hear anything suspicious (no matter how minor), please take the time to report it to Cornell Police (they can be reached by dialing 5-1111, or directly via one of the 19 emergency phones mounted in the hallways and elevators within our building).
2. Do NOT prop open any of the doors – either external or internal.
3. Take the time to lock and double check any doors you use.
5. Arrange your office/lab so that vulnerable items are not in plain view from hallways.
6. Permanently mark your vulnerable items.
7. Report any building security or safety issues to Steve Sparling (Building Coordinator, Rm. G40, 4-4583).

KEYS

At Orientation, you will receive a key to the Biotechnology Building in order to access the building after hours. Your Cornell ID will serve as a swipe card to get into other sections of the building after hours. Please help with building security by keeping all outside doors locked after hours and inside doors locked when the room or lab is not occupied. Keys must be returned to Steve Sparling before you leave Cornell. Note that there is a $5 fee to replace a lost key.

Once you have chosen a research lab, you will need to talk to your faculty advisor if you need additional keys as only he or she may request them.

PHOTOCOPYING

There are photocopiers on the 2nd, 3rd and 4th floors and a larger and faster machine is available during working hours in the 107 Biotech mailroom. (Please note that the copier in the main office is for administrative use only). You will need an access code to operate these copiers. All copiers accept the same access code. First-year students will get a number from the GFA to use until they settle into a lab. Once you have joined a lab, your major professor will provide the code that is used for your lab.

If you have a problem with a copier that you can't resolve, please report the problem to the MBG Department office (107 Biotech).

SUPPLIES

Students should obtain general office and lab supplies (3-ring binders, scotch tape, pens, etc.) from their lab managers or department supply room. First year BMCB students can obtain them from the supply cabinets in the 107 Biotech Mail Room between the hours of 8 am and 4 pm. All supplies must be signed out.

INFORMATION FOR FACULTY

BMCB MISSION STATEMENT

Introduction to life sciences Fields at Cornell, and to the Field of BMCB. Graduate education at Cornell is organized by Fields. Almost all Fields have an administrative home in a department. In some cases the faculty comprising the Field are virtually the same as those comprising the department. In other cases, including the Field of BMCB, not all the departmental faculty are members of a Field with a home in that department, and many outside-departmental faculty are members. Generally each Field acts independently in graduate student admissions, e.g. recruiting, selecting, financing, and interviewing prospective students who visit Cornell, although in some cases Fields recruit together. A second purpose of Fields, apart from graduate education, is to bring together faculty with similar research interests and thereby to promote collaborations and exchange of ideas.

The Field of BMCB has existed for over 40 years, in the recent past enrolling about 12 – 22 PhD students per year. There are about 65 faculty in BMCB, somewhat under one half of whom are in the Dept of Molecular Biology and Genetics (MBG), with the rest from the following departments or units: Chemistry and Chemical Biology (College of Arts and Sciences); Applied and Engineering Physics (College of Engineering); Physics (College of Arts and Sciences); Division of Nutritional Sciences (College of Agriculture and Life Sciences and College of Human Ecology); Microbiology (College of Agriculture and Life Sciences); Boyce Thompson Institute; Molecular Medicine (College of Veterinary Medicine), Microbiology and Immunology (College of Veterinary Medicine), and Biomedical Science (College of Veterinary Medicine), Department of Biomedical Engineering (College of Engineering) and Department of Chemical and Biomolecular Engineering (College of Engineering).

Outline of research areas. Viewed broadly, the research focus of the Field of BMCB is to uncover the fundamental chemical, biochemical, molecular biological, and cell biological principles that govern all forms of life. While the techniques and principles of "biochemistry", "molecular biology", and "cell biology" underlie much of the basic and applied research in modern biology and in medicine, research in BMCB labs goes beyond the methodologies implied by these terms. BMCB research typically is devoted to understanding the processes common to all cells, such as transcription, translation, DNA replication and repair, protein-nucleic acid interactions, biological pathways including signal transduction and metabolism, cell-cell communication, organelle function, macromolecular machines, protein structure and dynamics, membrane and cytoskeleton structure and function, and enzyme mechanisms. The research in the Field of BMCB focuses on quantitative and mechanistic types of analysis, as opposed to those that are qualitative and descriptive.

APPLICATION FOR FIELD MEMBERSHIP

General. The Field of BMCB welcomes faculty members who are strong scientist and are capable trainers of students, who do research and train in an area broadly relevant to BMCB, and who are willing to commit time and effort to the Field.

The Field of BMCB has its traditional and administrative home in the Department of Molecular Biology and Genetics (MBG) and most of the courses for BMCB grad students are taught by MBG faculty. However, the Field is open to applicants from any department at Cornell. For applicants from outside the MBG Department, they will already have a "primary" Field, and thus BMCB would be a "secondary" Field. Primary and secondary BMCB Field members have exactly the same rights and responsibilities. All BMCB faculty have equal access to grad students and to competitive slots for BMCB students on the NIH Training Grant in Cellular and Molecular Biology (CMB). All faculty are expected to participate

equally in administrative activities, Field committees, and graduate student recruitment and mentoring. All faculty are expected to teach key BMCB courses (Proposal Writing course, Careers course and Foundations & Frontiers course) on a rotating basis.

Membership in the BMCB Field implies a commitment to participate in Field activities. Those who already have multiple Field associations should make a convincing argument in their application that they will devote time and energy to BMCB.

Publications and invited talks. Applicants are expected to have an outstanding publication record in their research area, which should fall under the rubrics of biochemistry, molecular or cell biology, as sketched above. Publications should include first authored papers (or for senior faculty, corresponding authorship) in the most highly respected journals with wide readership in BMCB. Publications that are not in journals with a wide readership but are relevant to an application should be in the top ranked specialty journals that have editorial boards with expertise in BMCB. Applicants also should have been invited regularly to present their work at other universities and major conferences. The Field of BMCB is looking to raise the stature of the Field by recruiting faculty with research programs that surpass in excellence the present average of the Field membership.

Research funding. Applicants in their first year as independent investigators are expected to have a detailed plan for seeking research support from the NIH or other agencies, and the outlook for such support should be excellent. Applicants in their second year are expected to have received at least minor grant support and to have pending applications for major funding. Applicants in their third or later years should have a fully funded research program, with at least one major grant.

Training record. If they come from an academic background, senior faculty applicants to the Field are expected to have a record of training grad students and post docs who have been very successful in the next step in their careers.

Engagement with the BMCB community at Cornell. All applicants to the Field of BMCB are expected to be engaged with the Cornell community of research scientists in biochemistry, molecular and/or cell biology. Evidence for such engagement could include regular attendance at relevant seminars (for example the Friday 4pm series in the Biotech Bldg, sponsored in part by the Field of BMCB), or existing or planned collaborations with BMCB labs. For applicants who have recently arrived at Cornell, the probability of active engagement will be evaluated by the BMCB advisory committee.

Mechanism of application. Applicants should submit the following to the BMCB Director of Graduate Studies: a letter of intent including research plans for the future, a CV, and two letters of support from BMCB Field faculty (at least one of which should be from someone outside the applicant's department). The letter of intent and letters of support should discuss (a) what significant contributions the candidate has made and (b) how their research fits the BMCB training program.

The BMCB advisory committee will review the application in an expeditious manner. If the committee judges the research area and qualifications of the applicant to be suitable, the DGS will arrange for a Field seminar (normally in the Friday 4pm seminar series), and the CV will be circulated to all the Field members. Immediately after the seminar the Field will vote. The Graduate School requires that 2/3 of <u>all</u> Field members must vote "yes" for the applicant to be admitted to the Field. In cases where an application is submitted by a newly-arrived faculty member at a time that does not permit a Field seminar to be scheduled immediately, the DGS may nevertheless make special arrangements for that person to give a "rotation talk" to the first year BMCB class, before the applicant has been formally admitted to the Field.

For faculty new to Cornell who gave a job seminar within a year of applying for membership in the Field of BMCB, the requirement for presenting a seminar may be waived at the discretion of the DGS, if approximately two thirds or more of the Field is likely to have attended that seminar.

Financial commitment implied by Field membership. BMCB faculty members have agreed to share the costs for recruiting the first year BMCB class, and for supplementing the first year stipends to the university-mandated level. Those faculty who take a BMCB student at the end of the student's first year are required to contribute this amount to the Field of BMCB account. The costs may be reimbursed either by the individual faculty member or by his/her department. Until reimbursement is made, the faculty member in question will not be able to take further BMCB students.

RENEWAL OF MEMBERSHIP

The BMCB Advisory Committee will evaluate each Field member every seven years. A non-participating field faculty will be asked to resign. Criteria for non-participation: (1) the faculty has not mentored a student for thesis research or rotation, or served on a student special committee in the previous seven years; and (2) has not participated in any Field related committee nor taught a mini-course in the previous 7 years; and (3) has not participated in voting at least 50% of the time in the previous 7 years.

BMCB AND CMB TRAINING GRANT ADVISORY COMMITTEE

The DGS and TG Director appoint an advisory committee to provide advice in Field matters. The committee is broadly representative of research areas and departments. Current Advisory Committee members are: Marcus Smolka (DGS), Tony Bretscher (TG Director), Chris Fromme, Andrew Grimson, Natasza Kurpios, Sylvia Lee, and Carolyn Sevier.

APPROVAL OF FIELD PROPOSALS

A majority of all Field members must vote in favor of a measure involving Field policy in order for it to take effect.

POLICY ON PARTICIPATION IN THE TRAINING PROGRAM SUPPORTED BY NIH

Field membership does not automatically qualify faculty members to participate in the training program funded by NIH. Participation as a trainer requires active status as a member of the Field of BMCB and requires that the trainer will have had external research support within the past three years. The training grant PI (Anthony Bretscher) and Advisory committee will evaluate past performance of trainers at the time of application for competing renewal of the grant and remove inactive trainers from the program roster.

TRAINING GRANT AND STUDENT SUPPORT COMMITMENT

Admissions offers to students entering the Field of BMCB contain the phrase "…support based on satisfactory progress." The only resource available to the Field itself is the Cellular and Molecular Biology training grant and a few fellowships funded by the Graduate School for entering students. These are used to provide first-year support and a number of competitively awarded slots. Additional resource is needed to support recruitment cost for the interview weekends, and to supplement some fellowships so all students receive the same stipend. The BMCB Field has developed a finance model in which the faculty who accept students into their labs at the end of the academic year are required to share the cost for supporting

the stipend supplement of the incoming class and the recruitment cost in the upcoming Spring. Depending on the projected recruitment cost, as well as the supplement cost required, faculty (or their home department) are requested to contribute ~4-10K for each student they accept into the lab.

It is important to note that the Department of Molecular Biology and Genetics is unable to guarantee subsequent support for students who choose to work with faculty outside the department. The commitment for continuing financial support given to students must be accepted by the Field faculty member at the time that he/she accepts a student into his/her research group. In addition, a commitment on the part of the department to assume financial responsibility for the student, in the event that the mentor is unable to maintain sufficient grant support, also is required.

In general, training grant eligible BMCB students are put on the CMB training grant during their first year in the program. This usually uses up ~2/3 of the available training grant slots. The remaining slots will be used to fund 3rd and 4th year BMCB students on a competitive basis. The decision to appoint upper class students onto the CMB training grant is made each year by an ad hoc committee.

In general, students who have been funded by the CMB training grant cannot be appointed on other training grants. At a previous review cycle, the NIH reviewing committee raised serious concerns about students being supported by different training grants without strong justifications of additional training needs.

On rare occasions that a BMCB student will benefit from additional training programs beyond the scope of the CMB training grant, the student can be put on a different training grant if appropriate justifications are provided and permission is given by the CMB training grant PI. Prior to appointing any BMCB student who has previously been supported by the CMB training grant onto a different training grant, the PI of this student must send a letter/email to the CMB training grant PI (currently Anthony Bretscher) to describe the additional training needs, and how putting this student onto a different training grant will enable additional training activities (e.g. additional course work, participation in specialized journal clubs, conferences, etc.)

OTHER COMMITMENTS IMPLIED BY FIELD MEMBERSHIP

All Field members are expected to:

- Serve as advisors on student's Special Committee representing BMCB;
- Teach key BMCB courses (Proposal Writing course, Careers course and Foundations & Frontiers course) on a rotating basis;
- Serve on BMCB field-related committees (such as the Admissions or Recruitment Committee);
- Participate in BMCB Recruitment annually, whether actively seeking a student or not;
- Occasionally host a speaker for the Friday Seminars.

Field members must meet annually with every BMCB student whom they advise, along with the rest of the student's Special Committee. This meeting usually takes place immediately after the student's seminar (or soon thereafter). The student completes a Progress Report before the meeting. The major professor should go over this report with the student and then write an independent letter evaluating the student's progress. This letter becomes part of the student's file.

REQUIREMENTS FOR STUDENTS MINORING IN BMCB

For Ph.D. candidates with a minor in BMCB, the suggested requirements are at least six credits of advanced lecture courses (usually at the 6000-level, but some 4000-level courses may be appropriate, e.g., BIOMG 4370, BIOMG 4380, BIOMG 4450. Appropriate courses in BMCB include: BIOMG 6310, 6330, 6360, and 6390. 6000- and 7000-level courses in other departments, i.e., Chemistry & Chemical Biology, Plant Biology, Vet Molecular Medicine, and Vet Microbiology & Immunology, may also be suitable, as determined by the Special Committee. If a student who wants to minor in BMCB has not been exposed to appropriate lab work in the general area of BMCB, then he/she should also take the lab course BIOMG 4400.

For MS candidates with a minor in BMCB, the suggested requirements are at lest four credits of advanced lecture courses (and a lab if appropriate). Some suggestions for appropriate courses are indicated directly above.

Note that requirements are determined by Special Committees, and that the recommendations above are guidelines offered by the Field.

ROTATIONS

First year students are required to do three lab rotations with BMCB faculty during their first academic year. Faculty members who are interested in recruiting students give a 20 minute rotation talk to new students. These talks are scheduled on Tuesday and Thursday afternoons during the first half of the fall semester. Faculty should prepare a two-page handout summarizing their lab and their research, to hand out to the first year students one week before the rotation talk. At the end of a rotation period, the mentor must fill out a Rotation Evaluation Form (Appendix IV), which must be signed by mentor and student, and which becomes part of the student's file.

May students do a rotation in the lab of someone who is on sabbatical leave? In general, this is not advised unless the student plans also to do a fourth rotation. In rare cases, and where special provisions are made (including oversight by another faculty member), such rotations are acceptable with the approval of the DGS.

It is important to note that faculty should not commit to accepting a student into his/her lab for thesis research until the last day of classes in Spring semester (usually the first week in May). This is to ensure all students have a fair chance of completing their third rotations before faculty make a final decision.

STUDENTS WHO ENTER BMCB THROUGH AN UNTRADITIONAL ROUTE

Occasionally, graduate students who come from other institutions or from other Cornell departments inquire about transferring to BMCB. If those students are early in their career, they are encouraged to apply through the regular admissions procedures. If they are accepted, then they are treated like all of our students. In rare cases students may enter the program through a route other than the normal admissions procedure. Admission through this route requires approval by the DGS and the Chair of the Admissions Committee. In such cases, the Field member who takes the student accepts full financial responsibility for that student. The student may not be required to do all rotations, or to take the BIOMG 8310 laboratory course, but still must fulfill the teaching requirement. Other course requirements are established by the student's special committee.

TEACHING REQUIREMENT

It is a requirement that all students in the Field teach at least one semester, which they fulfill usually in their second year (see page 4 for details). In some cases, students enter the PhD program who already have extensive teaching experience. Very rarely the teaching requirement may be waived in such cases, with the approval of both the DGS and the Chairman of MBG.

ATTENDANCE AT STUDENT SEMINARS

Field faculty are required to attend the yearly student seminar (BIOMG 8330) as well as the thesis seminar of students on whose special committees they serve. In addition, Field faculty are expected to attend at least some of these seminars for other students.

APPENDIX I

GUIDELINES FOR STUDENT SEMINARS

(by V. Vogt and W. Brown)

THE ROOM: Seminars are held in 226 Weill Hall.. It is the student's responsibility to make sure that the room is open, the microphone is working, the LCD projector is set-up, and the chairs are in place. Make sure you have ample time to set things up before your seminar. If this is your first seminar, get help from veteran students.

TIME: For a full-period presentation, plan to talk for 45-50 minutes, leaving ten minutes for questions and discussion. For a half-period presentation, plan your talk for 20 minutes (25 minutes at the most). Sometimes unexpected questions will throw you behind schedule; even so, make sure you don't talk beyond the limit. Students giving their first talk often think that because they don't have enough data to fill the allotted time that they should abbreviate their talk. This is usually a mistake. Good speakers devote large portions of their talks to explaining why and how they are doing their analysis. Why is your research interesting? What questions have other people in the field asked? Thus, if you haven't had much time to develop your project, you can provide your audience with a fuller appreciation for the background of your project.

PRACTICE: Rehearse the talk beforehand! Most people practice at least twice in front of their regular lab group. Those who are not native English speakers are encouraged to add an extra practice session. When you rehearse, it is important to have someone in the audience who does not already know what you are talking about, who can tell you if everything is intelligible to the non-specialist. Perhaps the most frequent problem in the student seminars is that speakers assume the audience already knows the background and the techniques used.

VISUAL AIDS: PowerPoint "slides" are usually best here. Plan to use no more than about twenty slides (25 at most if some are very simple), with maybe half of these containing data (graphs, pictures of gels, etc.). Good quality slides are *extremely important*, especially for presentation of data. A common mistake in preparation of slides is to include too much information, or to make the lettering too small. Check beforehand to make sure that someone sitting in the back of the room can read everything. As an example, for Times font, titles should be 28pt (or 24pt at the smallest), and other lettering should be at least 20pt. Do not use complex color schemes for your slides. Put a simple title on each slide. "Cue" slides are especially useful to help keep the audience with you. Examples: flow charts; schematic pictures of gels; sentences giving the conclusions from what has been presented, or the next topic, or restating the question you are asking. Insufficient use of cue slides is perhaps the most frequent problem with student seminars. For data slides, it is helpful to write a one-phrase or one-sentence conclusion at the bottom of the slide, using PowerPoint animation. For complex data, such as tables of numbers, or gels with several lanes and bands, highlight the features that you want the audience to see, for example by enclosing in a red box (also animated as you point out different features). Use the laser pointer sparingly. Do NOT wave it around wildly, as this is extremely distracting. Do not circle the object you want the audience to see. Instead, point to the object on the screen, and then turn the pointer off again. Remember to face the audience and make some eye contact. Don't talk to the screen.

INTRODUCTION: Ten to fifteen minutes should be allotted to giving the background for your project. Do not assume, just because you have spoken in previous years, that people will remember the background for your project. Every seminar should be self-contained. State precisely what questions you want to answer, the hypotheses to be tested, and why they are interesting. Remember that part of the task of the seminar speaker is to convince the audience that it is worth listening!

YOUR RESULTS: As you talk, remember to say clearly what you did and what was done by others in the lab before you or in publications. A common mistake in writing, and sometimes also in talking, is to use the passive voice ("a gel was run . . .", "a gene was sequenced . . ."). If you did it, say so. If not, say who did. When you are referring to published papers with multiple authors, don't describe the results by saying that the senior author did the work. You won't like it either when the project on which you have slaved for years is referred to as the work of your thesis advisor!

Don't confuse data with interpretation of the data. Usually there are several ways to interpret the results of an experiment. Tell the audience which are strong inferences and which are weak. If it is your result, tell what needs to be done to make it more convincing. Don't use jargon! Don't just say, for example, you did "S1 mapping". Explain succinctly what the method is and why it is being used. Another common mistake is to switch from one slide to the next, presenting each as an isolated experiment. This is seldom the case. Usually there is some reason for doing the next experiment, so try to provide transitional sentences when changing slides. Example: "Having purified this new protein which we believe to be associated with the cytoskeleton, I wanted to see more precisely where in cells it is located. To do this, antibodies were prepared against the purified protein and used for immunofluorescence . . ."

CONCLUSIONS: A summation should be part of every seminar. What have you shown? What do you conclude from the results? What are your plans to further bolster your conclusions? What are your plans for the future?

CREDITS: It has become a convention to show a final slide with the names of those who helped you. Keep it brief – no more than one-half minute. Unless there are exceptional circumstances, do NOT recite the names and ways in which each person helped you. For example, it is quite sufficient just to acknowledge your mentor, thesis committee and lab members with one spoken sentence.

APPENDIX II

MORE GUIDELINES ON WRITING THE A-EXAM PROPOSAL & ORAL EXAM PRESENTATION

Scope of the proposal. The proposed work should be limited in scope, so that a postdoctoral fellow (perhaps with the help of a technician) could accomplish the bulk of the work in three years. Study sections that review grants are very critical of proposals that describe five times as much work as could actually be done, even if very good descriptions of experiments are given.

Once you have narrowed the topic, develop a few (say three) specific questions you want to answer. Don't write down questions that are too general. By being specific, the questions will keep your proposal focused on the topic. After you have come up with a few specific questions, sketch in outline form what experiments you might do to answer them. Then work through the details to flesh your ideas out as a real proposal.

Your proposal will be judged for its innovation, quality and organization. Your thoughts should be developed logically and should represent some real insight in the field. The exam is meant to challenge your thinking and provoke discussion between you and your examiners. The format does not serve a useful purpose if the proposal and the exam:

1. Simply espouses "the party line" and echoes common themes in the lab.
2. Does not address interesting issues in the field.
3. Proposes only a small incremental advance in research.
4. Offers only pedestrian solutions to problems.
5 Fails to evoke dialectics[2] and debate.

Preliminary data. An important section of all grant proposals is the progress report or preliminary data. However, this section is not a deciding element in the A exam, and students may not put off taking an A exam for want of more data. Preliminary data are useful in charting the future course of research; however, the A exam is not intended to judge research accomplishments, but to assess the prospects for research based on the student's ability to conceive, investigate and defend a research proposal.

Specific aims. This section states crisply the hypothesis you are testing, or the questions you will try to answer. It also provides a list of each separate approach (aim) you will use to reach the overall goal. Use subheadings if appropriate.[3]

Research designs and methods. This is the meat of your proposal and should be organized according to the specific aims and presented clearly. Critical experiments should be described so that examiners appreciate your mastery of the subject. Experiments, important controls and contingency plans need to be fully described.

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[2] A method of argument or exposition that systematically weighs contradictory facts or ideas with a view to the resolution of their real or apparent contradictions.

[3] One format might be: "The overall aim is to..." or "The long term goal is to.....", followed by one or a few sentences. Then the actual specific aims could simply be listed, perhaps with subheadings 1. [1a,1b]; 2. [2a,2b,2c]; 3. Often the best way to phrase your aims is in terms of an hypothesis: "The hypothesis to be tested is that....."

Outline for each of the specific aims (use the same headings and subheadings) how you will proceed to test the hypothesis or answer the question posed. Give enough detail so the reviewer can judge if the experiment is likely to work. You don't need to give details about common procedures since these can be referenced. For example, molecular biological methods that are described in a manual such as Current Protocols in Molecular Biology needn't be repeated (buffers, times of incubation, etc.). But if there is a basic protocol you rely on for a large fraction of the work, you should lay it out for the reader. The reviewer is looking for indications that you have carefully thought out every step in the proposed procedure. If you are not sure every step is feasible, then indicate and describe what you will do if the step doesn't work.

There are several types of design problems that occur frequently, both in A exam proposals and in real grant proposals.

1. *Achieving the goal requires finding something.* A favorite criticism of some kinds of proposals is that they are nothing but "fishing expeditions" (by implication, with little chance of catching a big one). Don't plan to spend more than a fraction of your research time seeking something that you may not find.[4] Even if the payoff looks large, and if the chances look good, you won't get grant money (at least not at the beginning of your career) if a search is the main thing the proposal is about. Build into the proposal experiments that will yield results no matter how they come out.[5]

2. *Too many contingencies.* If achieving a major goal Z requires you first to achieve Y, and Y requires X, and so forth, the probability of reaching the end goal Z may not be high.[6]

3. *Limitation of starting material.* Know how much starting material is available, how much this costs to obtain (money or labor), and what size of an operation you would need to work it up to achieve your goal.[7]

An important part of the "Experimental Design and Methods" section is a description of how data will be interpreted. This is especially true for quantitative data. No one obtains funding just to make

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[4] For example, don't draw up a proposal with the major aim to identify by differential display a cDNA representing a messenger RNA that is produced in mammalian cells in response to growth factor stimulation. That is truly a fishing expedition and there is not much to say about the cDNA until it is found. Or as another example: suppose you want to study what proteins interact with a yeast cytoskeletal protein, by mutating the gene for that protein, and then cloning second site suppressor genes. This is an excellent approach and has many precedents. But even so, the second site suppressors may not be obtainable. Hence, in the absence of direct evidence that this approach is workable in your system, don't put all your eggs in this basket.

[5] For example, if you are studying a particular protein that is available in pure form, do some enzymological characterization that will answer an important question, or map functional domains of the protein by mutagenesis—in such cases whatever you find or measure may be useful.

[6] For example, suppose you want to study the properties of a very minor cellular protein, say the protein product of the mos oncogene. Your plan is to purify the protein, make monoclonal antibodies, use the antibodies to fish out the right gene from a cDNA expression library, hook up the gene to strong inducible promoter, insert this construct into an E. coli expression system, induce and finally purify the protein. All these are standard steps, but the chances of success, starting with no knowledge about the protein, are slim. Purifying minor proteins may be difficult (suppose this one is membrane bound and inactivated by detergents). Maybe the protein is not very antigenic in mice. The monoclonals may well not work in the western blot screening procedure. The expressed protein may be toxic even low doses, or it may well precipitate in the cell. Don't base too much of the proposal on such a series.

[7] For example, don't propose to grow primary animal cells in culture as a source for a minor protein you want to purify in milligram amounts. Think ahead that one plate of cells, costing roughly a dollar in plastic plus growth medium, contains only a milligram of total protein. Since you would need thousands of plates to obtain enough starting material, this strategy would not be workable.

measurements! Grant proposals are frequently criticized because the results obtained will be "purely descriptive" (a favorite phrase of criticism often levied by reviewers). What is the meaning of the data you hope to collect? Being explicit about your interpretations is a key element in convincing the reviewer that the papers you write will make a significant contribution to the field (instead of confusing the field so that others will need to clean up afterwards, as so often happens).

At the end of the "Experimental" section, it is wise to put in a paragraph or two about possible pitfalls. Nothing is guaranteed to work. If you let the reviewer know what you think the major limitations are, then you make clear the fact that you have thought about them. If you anticipate a potential problem, then you should indicate what alternative procedures you will use to get around it.[8]

Figures and tables. Figures and tables are often useful as an aid to the text. It is quite appropriate to reproduce figures from a review or other important article (state clearly from where taken). Figures may also be useful to show the reader what data you expect and how the data will be interpreted. Key figures and tables should be placed in the appropriate positions in the text and **they count toward the page limits**.

Writing style. Finally, matters of writing style and impeccable grammar are absolutely essential for successful proposals. Simple flaws can mar an otherwise perfect proposal. The A exam proposal is an exercise in meeting the highest standards of style and presentation. Good writing is an essential component in your quest for funding! If you are famous, you may get a poorly written grant proposal funded. However, most of us have seen funding denied to very well established investigators who have submitted carelessly or poorly written proposals. On the other hand, if you are not well known, given the competition for research funds that exists today, your proposal will almost certainly remain without financial support if it is poorly thought out or poorly written. In a well-written proposal, the eye of the reader moves down the page in an unbroken manner, from sentence to sentence and paragraph to paragraph. The logic of the presentation is so clear, and the writing so free of distractions, that he/she almost never has to read a sentence twice. This requires good use of transitions, between sentences[9] and between paragraphs.[10] A particularly important principle of good writing that is often neglected is paragraph structure. Each paragraph should have a topic sentence (usually the first sentence) that tells what the paragraph is about. Another principle is to use uniform tense.[11] Yet another principle (often mis-taught by teachers of scientific writing) is to avoid overuse of the passive voice.[12] Keep in mind that

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[8] For example, suppose you plan to overexpress a certain foreign protein by introducing the gene into CHO cells along with the gene for dihydrofolate reductase, and then selecting for gene amplification with methotrexate. This is a reasonable procedure, but it might turn out that the protein is toxic to the cells, and thus production will not be high, or the protein may become mutated to a less toxic form, or the clone may simply not be obtainable. You should anticipate these problems, and indicate if troubles arise, a different eucaryotic expression system (for example baculovirus) will be used instead.

[9] A transition can be a word or a phrase or clause showing how what follows relates logically to what came before. For example: "However,..."; "Nevertheless,..."; "In addition,..."; "By contrast,..."; "In order to..."; or "Based on these results,..."; etc.

[10] For example, "To generalize these observations, ..."; "With the aim of elucidating the molecular biology of this phenomenon,..."; etc.

[11] There is a lot of confusion about usage of tense in scientific writing, and also some leeway. In general, if you are describing particular experiments that were done in the past (either yours or those of others), use the past tense. "Optimal conditions for cell growth <u>were established</u>"; "The blot <u>was hybridized</u> with nick-translated probe from clone X"; "Smith et al. <u>cloned</u> the receptor gene." By contrast, if you are describing generalizations, or making a statement that had validity and still has validity, use the present tense. "Smith et al. <u>showed</u> that the fms oncogene <u>has</u> a protein kinase activity." No matter what convention you use, do not switch between tenses without good reason.

[12] There is nothing wrong with saying, "Harris and Jones investigated the relationship....", or "We investigated...", or (for example, in the context of a proposal) "I will investigate..." To the contrary, active voice is much preferable to the passive "The relationship was investigated by Harris and Jones..." In this latter case at least the identity of the actors (H and J) is clear. But if you say, "The relationship was investigated..." (meaning "we" did), the reader may well be confused who did it.

a well-written proposal requires multiple revisions. Each word and sentence should say exactly what you want to say—no more and no less.

Time required to prepare the proposal. You should plan to spend about one month of full time work to prepare your proposal. Some students can do the background research and then write a thoughtful proposal in three weeks, while some take six weeks. Two months is definitely too long!

Oral defense. Students generally prepare a PowerPoint presentation. The presentation generally contains one or two slides to cover the background of the proposal briefly, then one slide for each Specific Aim. Figures from the written proposal can also be shown.

Overuse of the passive voice is a common hallmark of poor scientific writing, and is frequently accompanied by this sort of confusion. Get in the habit of using active voice, at least at the start of a paragraph or description, to identify authorship absolutely clearly. Then in continuations of the descriptions, if no ambiguities arise, you may use passive, in order to emphasize the results instead of the authorship.

APPENDIX III

PREPARATION FOR THE A EXAM: ADVICE FROM CURRENT STUDENTS

Getting Started:

- ✓ BMCB, GGD, and Biophysics policy is that you take your A Exam **by the beginning of your fifth semester** (September 15 of your third year).
    - This is earlier than the deadline set by the Graduate School – talk to your committee if there are extenuating circumstances. They have *some* leeway to extend this deadline.
- ✓ **Get your committee to agree on a date** for your A Exam before you start writing. Anticipate that it might take a couple tries to find a time that works for everyone.
    - Your PI or committee members may be traveling in the lead-up to your A Exam and be less responsive to emails. This is a good thing to know ahead of time.
    - You need to have **one faculty member who is not a member of your committee** present at your A Exam. It can help to identify a couple potential people in case one is very difficult to schedule with.
- ✓ **Discuss a timeline with your PI** early on. They can help you to break things down into concrete steps with intermediate deadlines.
    - Your PI is allowed to read and give feedback on your draft **once** throughout the process. Agree on a deadline to submit that draft before you even start writing.
- ✓ You should plan to work on your A Exam for **approximately 8 weeks.** This includes reading background literature, writing your draft, getting feedback on your draft, and giving a practice talk.
    - It's a good idea to start thinking about when you want to have the A exam by midspring semester of your second year so you can figure out when to start the 8-week countdown.
    - When you plan out your timeline, make sure you leave **buffer time** for people to read your draft**.** They are not going to drop everything to give you feedback the minute you send it to them.
    - You will need to submit your final proposal to your committee **7 days before your A Exam**. Include this in your timeline.

Reviewing the Literature on Your Topic:

- ✓ Keep a list of papers you think are relevant to your project and check them off as you read them.
- ✓ One of the best places to look for papers to read is other people's reference lists:
    - Ask the other members of your lab for the reference lists from their A Exams.
    - Look at the papers that were cited in your lab's recent publications.
    - Compare the reference lists for several recent reviews in your field – which papers overlap? Those are likely important.
- ✓ Be realistic about how many papers you can read ***thoroughly*** at a time. This is specific to you, but you probably can't read papers all day and retain anything from them. (Be honest.)
- ✓ Take notes/write summaries as you read papers. It will be much faster to re-read your own notes than to re-read the whole article again.
- ✓ Pay attention to the methods used in papers. Your committee will ask you about them.
- ✓ Make sure you are reading both foundational papers in your field (including the older ones) as well as keeping up with the very recent advances related to your project.

Writing Your First Draft:

- ✓ Nobody writes a perfect first draft. **Anticipate and plan for writing multiple drafts**.
- ✓ **Be realistic about the scope of your project**. It is really tempting to write an overlyambitious proposal but your committee wants to know that you know what is feasible.
    - Break down a big question in your field into smaller, specific questions. Think about the simplest experiment to give a clear answer.
    - You may get feedback that you need to remove a sub-aim (or even a whole aim) that you really love. The other person is probably right.
- ✓ You do not need to include every single detail in your proposal – you won't have space anyway. Think critically about what is necessary to understand the proposed work, what you can assume a reader knows, and what is readable.
- ✓ **Think about how your proposed work will divide up into manuscripts**. How many papers do you think you will get? What will be in those papers? Will you publish them all at the end of your PhD or could you publish one sub-aim partway through?
- ✓ The guidelines for the three Graduate Fields are slightly different regarding the written proposal. Make sure you know what the expectations are for your Field.

Getting Feedback:

- ✓ **Ask for feedback on your draft(s). Seriously.**
    - Lab members are a great resource, especially post-docs in your lab. They can suggest relevant papers, techniques to consider, pitfalls of your proposed work.
    - The members of your lab are also unusually familiar with your project and the methods you are writing about – much more than your committee is. **Make sure you also get feedback from people outside your lab.**
- ✓ You are allowed to ask anyone for feedback, including faculty. Don't shy away from asking your committee members, other faculty members, even your undergrad PI for advice. **Just make sure the final product is your own work.**
- ✓ **Give people at least a week to read your draft**. You should anticipate that some people you ask will be too busy (and may or may not actually tell you "No").
    - It is best if you can give people time over the weekend to read (i.e. don't send it to them on Monday and hope for feedback by Friday).

Giving a Practice Talk:

- ✓ **Give a practice talk.** It is good practice and will likely make you feel less nervous.
    - The week after you have submitted your final proposal to your committee is a good time to do this.
- ✓ **Invite people who you think will give you good feedback**, not just your closest friends or members of your lab.
    - Invite people who know how your committee members think and what kinds of questions they tend to ask – like members of their labs and people who share committee members with you.
    - Invite people who you know will challenge you and ask hard questions.
- ✓ The MBG Diversity Council members are very willing to attend practice talks! Please feel free to reach out to Dashiell (dm792) or Mariela (mn548) and we will find people to come.
- ✓ Make your practice as similar as possible to your real exam.
    - Try to reserve the same room you will use for the real thing.
    - Present the slides you plan to use. Get feedback on whether the slides are neat and clear, with a large enough font. **Too much information on a slide is worse than too little.**
    - Make yourself practice drawing any "chalk talk" elements that you plan to include.

Taking the A Exam:

- ✓ Get some sleep the night before!
- ✓ You should bring a printed A Exam Results Form, a copy of your transcript, and copies of your written proposal (even though your committee will probably bring their own copies).
    - You do not need to bring coffee or food for your committee. This can be a logistical and financial burden – and you don't need any more stress on the day of your A Exam.
- ✓ Remember to breathe! Your committee is on your side and wants to see you succeed, even if they are challenging you. They are not out to get you.
- ✓ It is ok to ask for a bathroom break or a short breather if you want to step out and calm down for a minute.
- ✓ Your committee is interested in asking you questions to assess your knowledge of your project. They are not expecting to hear an uninterrupted presentation of your proposal.
    - The amount of preliminary data you have is less important than your ability to explain your proposed project and to interpret your data in a logical way.

      ○ Be open to models/questions/concerns that you have not considered and think through them with your committee.
      ○ Be ready to talk about how you would interpret different potential results of your proposed experiments, and how you would follow up on them.
      ○ Know the limitations of your proposed methods, and be prepared to discuss which questions your project will **and will not** be able to answer.
- ✓ If you don't know the answer to a question, **do not make something up**. It is ok to say that you don't know something – just be honest about it. You can also speculate about it and explain to them why you're making the hypotheses you're making.

Outcomes of the A Exam:

- ✓ Your committee will decide on the outcome of your A Exam immediately after you finish. You will wait in the hallway while they make a decision.
- ✓ It is fairly typical to be given a "conditional pass," which means your committee wants you to do additional work before allowing you to pass.
- ✓ Some examples of "conditions":
    - An additional course on a relevant topic
    - A 1-2 page annotated bibliography of relevant papers relating to a sub-aim that were not cited in the proposal
    - Restructuring or expanding an aim to provide greater detail on the methodology or analysis plans
    - Reorganizing the introduction to improve clarity

Logistical Information:

- ✓ You must submit a **Schedule A Exam Form** **at least 7 days before the A Exam. The Graduate School is very strict about this deadline.**
    - This form is signed by your committee members, the DGS, and one of the GFAs.
    - The additional faculty member (not on your committee) does not need to sign.
    - Get the GFAs to sign your form last – they can submit your form for you.
    - There is no reason not to submit this in advance so you don't forget.
- ✓ You must submit the final proposal to your committee **at least 7 days before the A Exam**.
- ✓ You must submit the **A Exam Results Form** **within 3 days after the A Exam.**
    - **Bring a printed copy with you to your A Exam.**
    - This form is signed by your committee members, the DGS, and one of the GFAs.
    - The additional faculty member (not on your committee) does not need to sign.
    - Get the GFAs to sign your form last – they can submit your form for you.

APPENDIX IV

ROTATION EVALUATION FORM

Field of Biochemistry, Molecular and Cell Biology

Rotation Student: _____ Professor: _____

Rotation Period Dates: From _____ To: _____

The following categories are designed to help you in the evaluation of this student. Use a letter grade, A-F, for each quality that you are able to evaluate based upon your observation during the rotation period.

Use the grading scale appropriate for graduate level courses: i.e. *an A grade represents outstanding performance,* ***a B grade should be the average grade for our rotation students, an acceptable grade for good performance***, *C or lower grade indicate unacceptable performance and will be considered as a "failed" rotation.*

_____ Effort to learn the background and read the literature in project area.

_____ Effort to master the necessary techniques in project area.

_____ Proficiency and accuracy in lab work.

_____ Analytical skill in interpreting data obtained during rotation.

_____ Independent critical thinking about the project (evidence of creativity).

_____ Maintenance of a careful and well-organized lab notebook.

_____ Motivation and enthusiasm for research.

_____ **Overall letter grade for rotation.**

Please indicate in a 1-5 scale whether you would be willing to take this student into your lab and explain your choice:
("5" I would definitely be willing to take this student into my lab, assuming he/she were interested and assuming I had space and sufficient financial support. "1" I would NOT be willing to take this student into my lab, even if I had space and sufficient financial support.)

Comments *(use separate page if needed):*

Faculty Signature _____ Student Signature _____Date: _____

APPENDIX V

WHAT MAKES A GOOD PHD STUDENT?

There are many ways to succeed as a graduate student. Here is an article I like, and I hope it gives some tips to help you fulfill your potential as a successful and independent scientist. (Sylvia Lee, July 2011)

NATURE|Vol 441|11 MAY 2006

What makes a good PhD Student?

Doing a PhD should be fun and rewarding, because you can spend all your working time discovering things and pursuing ideas — and getting paid for it, without any administrative responsibilities. Those who stick with a career in science do so because, despite the relatively poor pay, long hours and lack of security, it is all we want to do. Unfortunately most new PhD students are ill-prepared, and as a consequence very few will fulfill their aspirations to be independent scientists. The main reasons for this are the 'grade creep' inherent at most universities, making it difficult to identify the really talented first-class graduates from the rest, and the pressure on universities to graduate as many PhD students as possible. The consequence is that we enroll far too many of them without telling them clearly what doing a doctorate should entail. We therefore set ourselves, and the students, on a path of frustration and disappointment.

So what should we be telling prospective PhD students?

●Choose a supervisor whose work you admire and who is well supported by grants and departmental infrastructure.

●Take responsibility for your project.

●Work hard — long days all week and part of most weekends. If research is your passion this should be easy, and if it isn't, you are probably in the wrong field. Note who goes home with a full briefcase to work on at the end of the day. This is a cause of success, not a consequence.

●Take some weekends off, and decent holidays, so you don't burn out.

●Read the literature in your immediate area, both current and past, and around it. You can't possibly make an original contribution to the literature unless you know what is already there.

●Plan your days and weeks carefully to dovetail experiments so that you have a minimum amount of downtime.

●Keep a good lab book and write it up every day.

●Be creative. Think about what you are doing and why, and look for better ways to go. Don't see your PhD as just a road map laid out by your supervisor.

●Develop good writing skills: they will make your scientific career immeasurably easier.

●To be successful you must be at least four of the following: smart, motivated, creative, hard-working, skilful and lucky.

You can't depend on luck, so you had better focus on the others! ■

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www.qimr.edu.au/research/labs/georgiat/Guideforphds.doc

APPENDIX VI

PLANNING FOR A POSTDOCTORAL POSITION

The Cornell Office of Postdoctoral Studies is a good resource for students looking into postdoctoral positions. (https://postdocs.cornell.edu/) and has a detailed list of things that you should do as you search for a position.

1. Timing:

Begin looking a year or more before you are ready to graduate; remember, it often takes more than a year to find the right lab and to secure funding.

2. Finding a lab:
   - There is a listing of available postdoctoral positions posted on the 1st floor bulletin board; read it frequently.
   - Read the journals and look for labs that are doing interesting work, contact the P.I.
   - Ask the advice of your advisor, other faculty members, etc.
   - Attend seminars and talk to the speakers.
3. Selecting a lab:
   - Pick the 3-4 labs that are your top choices for a postdoctoral.
   - Write a letter to the P.I. Describe the work you've done and why you'd like to join their lab.
   - Enclose a CV.
   - Ask your major professor and 2 others to write recommendation letters for you. (Arrange to have these letters arrive shortly after your own.)
   - Follow up with a phone call after a reasonable amount of time if you haven't had a response.
   - VISIT THE LAB! Plan to give a seminar, or at least explain what you're doing; talk to P.I. and lab members about projects they are working on.
   - The best way to know your fit in a lab is to talk to lab members; also check track record of previous lab members and find out if P.I. is supportive of lab members moving on (e.g. post docs taking projects to start their own labs).
4. Sources of postdoctoral funding:

Write applications with the help of your postdoctoral advisor. Be sure to allow enough time; remember how long the A-exam took? Give a copy of your proposal to your major professor and several others asking for their comments and suggestions.

The following are examples of foundations that offer postdoctoral fellowships.

- American Cancer Society
- Damon Runyon-Walter Winchell Cancer Fund
- The Jane Coffin Childs Memorial Fund for Medical Research
- Life Sciences Research Foundation
- The Helen Hay Whitney Foundation
- NIH, NRSA
- Arthritis Foundation
- Juvenile Diabetes Research Foundation
- American Diabetes Association
- Leukemia Society of America
- Muscular Dystrophy Association
- American Heart Association