

**The Graduate Field of
Biochemistry, Molecular and
Cell Biology**

Blue Book

Fall 2008

(Revised September 2008)

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 and Development, most recently assembled by Eric Alani. We thank him for their efforts.

If you have corrections or suggestions for changes, please send them to Diane Colf at 107 Biotechnology Building, or email them to her at dmc18@cornell.edu.

TABLE OF CONTENTS

	Page
Preface	i
Table of Contents	ii
History of the Department of Molecular Biology and Genetics	iv
Graduate Program	1
Registration	1
Special Committees	1
Coursework in the Major	2
Choosing a Minor.....	3
Laboratory Rotations.....	5
First Year Evaluation	5
Teaching.....	6
Monday Graduate Student Seminar.....	7
Other Seminars.....	7
Journal Clubs.....	8
Progress Reports.....	8
Conflict Resolution	9
Vacation	9
Admission to Candidacy ("A") Exam.....	9
Thesis.....	17
Final Thesis Seminar.....	18
Thesis Defense ("B") Exam.....	18
Masters Degree.....	18
Grad Student Life	19
Financial Information	21
Field Support.....	21
Methods of Payment to Graduate Students.....	21
Travel.....	22
Awards.....	22
Other Important Information	23
Building Security.....	23
BioResource Center.....	23
Biotechnology Flow Cytometry and Imaging Facility.....	24
Bus Transportation.....	24
Computing Resources.....	24
Electronic Shop.....	24
FAX Machine.....	24
Federal Express.....	24
Keys.....	25
Lost and Found.....	25
Mail.....	25
Parking.....	25
Paychecks.....	26
Photocopying.....	26
Proper Disposal of Laboratory Wastes.....	26

Other Important Information (continued)	page
Reading Room.....	27
Telephones.....	28
Theses from Former Students.....	28
Miscellaneous Information for Faculty	29
BMCB Mission Statement	29
Application for Field Membership	29
BMCB Advisory Committee	31
Requirements for Students Minorng in BMCB.....	31
Training Grant and Student Support Commitment.....	31
Other Commitments Implied by Field Membership	31
Rotations.....	32
Students Who Enter Our Program through an Untraditional Route.....	32
Teaching Requirement.....	32
Attendance at Thesis Seminars.....	32
Appendix I Guidelines for Student Seminars.....	33
Appendix II Rotation Evaluation Form.....	35
Appendix III Planning for a Postdoctoral Position.....	37
Appendix IV Foundations that Award Postdoctoral Fellowships.....	38
Appendix V Progress Report for Biochemistry, Molecular and Cell Biology.....	39
EMERGENCY NUMBERS	Back Page

History of the Department of Molecular Biology and Genetics

James B. Sumner started teaching at Cornell in 1914. For many years, until the medical college moved to New York City, he taught biochemistry to the medical students. It was during this time that he made an important discovery that revolutionized biochemistry. In 1926, after nine years of unsuccessful efforts, he succeeded in crystallizing the enzyme urease and announced in a publication that it appeared to be a pure protein. This discovery was greeted at first with skepticism or even with derision. Because of Sumner's beautifully designed experiments and his extraordinary tenacity, his view that enzymes are proteins finally prevailed. It forms the basis of all modern enzymology. For this work he won the Nobel Prize in 1946. During his career at Cornell, he attracted excellent students and collaborators to work under his guidance, carried on his research on enzymes, lectured on biochemistry, taught a biochemistry laboratory course, wrote the major textbook of the time in enzymology, and edited a series of volumes called *The Enzymes*, which played an important part in the development of enzymology. He continued to be active in teaching and research until his death in 1955.

The Department of Biochemistry was formed in 1945, facilitated by a grant of \$200,000 from a feed company for a building to be named in honor of Professor E.S. Savage, originator of "open formula" feeds. The new department was led by James B. Sumner. In 1985, an annual lectureship was established in honor of James B. Sumner to bring distinguished biochemists to Cornell. This lectureship was endowed by Sumner's family and former students and associates and the Class of 1942. Professor Walter Nelson, who had been a student under Sumner before becoming a professor in the department, devoted the last few years of his life to the establishment of this lectureship.

In 1957, Robert Holley became a member of the Biochemistry Department, although his major appointment was as a chemist at the U.S. Plant, Soils, and Nutrition Laboratory at Cornell. Together with a group of postdoctoral fellows, graduate students in biochemistry, and chemists at the Nutrition Laboratory, Professor Holley was able to isolate several pure species of transfer ribonucleic acid (tRNA). In 1965, as the culmination of a pioneering set of experiments, Holley and his group published the sequence of nucleotides that composes one of these RNAs. Determining this first nucleic acid sequence was a landmark achievement. It opened up the new era of molecular biology in which the sequencing of RNA and then DNA from all types of organisms became possible. For this work Holley was awarded the Nobel Prize in 1968.

When the Division of Biological Sciences was organized in 1964, the Department became a Section of the Division, and its name was changed to Section of Biochemistry. Professor Robert Morrison, director of the Division, made his first priority establishment of a strong biochemistry group that would serve as a nucleus around which the rest of the division could grow. Morrison and Holley persuaded Efraim Racker to come to Cornell to become chair of the new Biochemistry Section, and Holley and Racker convinced two senior scientists, Leon Heppel and Quentin Gibson, to help anchor the group. Funds were provided for an addition to Wing Hall with modern research laboratories. When Racker arrived in 1966, he brought with him several junior faculty including Ray Wu, June MacDonald, Gottfried Schatz, Richard McCarty, and Peter Hinkle. This had the effect of creating a strong center for membrane research. Racker developed a series of new methods to reconstitute biological membrane structure and function and he and his group used these techniques to obtain the experimental support for the Peter Mitchell chemiosmotic hypothesis. Racker was awarded an Einstein Professorship by the State of New York. For Racker, science was six days a week, and on Sunday he painted. We can enjoy some of his pictures, which still hang in the Biotechnology Building today.

When Ray Wu came to Cornell in 1967, he switched his interest from carbohydrate metabolism to the structure of DNA. Working with lambda phage, he did some of the first DNA sequencing.

The Section's name was changed in 1966 to Section of Biochemistry and Molecular Biology, reflecting the growing importance of molecular biology. By 1978, the core of the molecular biology group was made up of Joseph Calvo, Elizabeth Keller, John Lis, Jeff Roberts, Bik Tye, and David Wilson. In 1972 it was decided to expand the section to include cell biology. Several new cell biologists were added to the faculty, and the name was changed to Section of Biochemistry, Molecular and Cell Biology. Anthony Bretscher, William Brown, Jane Gibson, and Volker Vogt formed the core of the cell biology group and they were later joined by Tim Huffaker. To accommodate the new molecular and cell biologists, two floors of modern research laboratories were added to the annex of Wing Hall.

In 1988 all of the faculty in the Section of Biochemistry, Molecular and Cell Biology moved to the newly constructed Biotechnology Building. Previously most of BMCB faculty had been housed in Wing Hall, but some had been in Savage and Clark Halls. At the same time, the faculty in the Section of Genetics and Development, which had been in Bradfield Hall, also moved to the Biotech Bldg.

In November, 1998, Cornell President Hunter Rawlings announced that molecular and cell biology would be a major area of development in the near future. As part of this initiative, on July 1, 1999, the Section of Biochemistry, Molecular and Cell Biology (BMCB) and the Section of Genetics and Development (G&D) were fused into one new department: the Department of Molecular Biology and Genetics (MBG). This new department is the administrative home for two separate Graduate Fields (BMCB and G&D). These two major graduate programs associated with the Department currently have about 150 Ph.D. students. The graduate Field of BMCB and the graduate Field of G&D each have an NIH training grant to help support graduate students.

The BMCB Field faculty include several distinguished senior members: Leon Heppel (now emeritus), Harold Scheraga, George Hess, Watt Webb, Jeffrey Roberts, June Nasrallah, and Scott Emr are members of the National Academy of Sciences. Jeffrey Roberts is the Robert J. Appel Professor; David Shalloway is the Greater Philadelphia Professor, and Joseph Calvo (now emeritus) was named Cornell's first William T. Keeton Professor. Watt Webb is the Samuel B. Eckert Professor in Engineering. More recently, John Lis was named Barbara McClintock Professor and Maureen Hanson was named Liberty Hyde Bailey Professor. Susan Henry is the Ronald P. Lynch Dean of the College of Agriculture and Life Sciences

The most recent development in the history of the Field of BMCB and the Dept. of MBG is the establishment of the Weill Institute of Cell and Molecular Biology, headed by Scott Emr and located in the new Weill Hall adjoining the Biotech Bldg. Many of the faculty in the Institute will be MBG members, and most probably will become affiliated with the Field of BMCB.

Elizabeth Keller, 1995 (modified by Bill Brown, 1999 and Volker Vogt, 2008)

GRADUATE PROGRAM

REGISTRATION

New students should register on the first day of registration week; continuing students may register on any day of registration week except the first day of registration. **A student must register at the beginning of each term 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 to register for. Before you register each term, your bursar's bill should acknowledge the receipt of your financial assistance. If not, check with the Field Assistant (107 Biotech Building) to rectify the situation.

Remember also to register for the **summer semester** by the end of May. This is necessary for the use of 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. You can now do this on line at the Graduate School web site: www.gradschool.cornell.edu.

If you are not going to be present for registration **due to university business**, you must notify the Field Assistant to avoid paying the late registration fee (\$200). During August and January we receive a request from the Graduate School for the names of any graduate students who will register late because of an absence due to field research or conference attendance. Any student appearing on this list will not be charged the late registration fee. Please notify the Field Assistant and request that a waiver of the late registration fee be filed and provide him with the reason for your absence from campus. It is a good idea to put your name on this list even if there is only a slight possibility of missing registration. There is a three week grace period after registration before a late filing fee is charged.

SPECIAL COMMITTEES

One of the most important decisions you will make as a graduate student at Cornell involves 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. Students assemble a Special Committee at the end of the first year, but 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, can they help you with certain experiments, etc.

Once your committee has been selected, don't panic if you realize as your research program develops that someone else might be more appropriate. Changing your Committee requires agreement from old and new members and a form called a "Special Committee Selection and Change" form,

available on-line at the Graduate School web site: <http://www.gradschool.cornell.edu/p=11> or from the Grad Field Assistant. Although it is easier to make committee changes before the Admission to Candidacy exam, it is possible to do so afterward as long as the new member accepts (in writing) the results of your exam.

You are required to meet with your entire committee at least once a year to discuss progress and plans (see PROGRESS REPORTS). 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. To notify your committee of your seminar, invitation cards are available from the Graduate Field Assistant in the main office (107 Biotech). 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

FIRST YEAR STUDENTS

Laboratory research:

BIOBM 831 Advanced Biochemical Methods I - Lab 01 (weeks 1-7) (Huffaker; fall)

BIOBM 831 Advanced Biochemical Methods I - Lab 02 (weeks 8-14) (staff; 1st rotation; fall)

BIOBM 832 Advanced Biochemical Methods II (staff; 2nd and 3rd rotations; spring)

One protein course:

BIOBM 631 Protein Structure and Function (Nicholson; fall)

CHEM 686 Physical Chemistry of Proteins (Crane, fall) (note: conflicts with BioBM 831 but could take this in second year)

One cell biology course:

BIOBM 636 Advanced Cell Biology (Bretscher/Brown; spring)

One of the following courses in molecular biology:

BIOBM 633 Biosynthesis of Macromolecules (Roberts/Wilson; fall)

BIOBM 639 The Nucleus (Lis; spring)

Plus two courses chosen from the following suggested list:

BIOBM 437 Eukaryotic Cell Proliferation (Lee; spring)

BIOBM438 The RNA World (Ke, 3 cr, spring)

BIOBM 439 Molecular Basis of Human Disease (Kraus; fall)

BIOBM 450 (=CHEM 450) Principles of Chemical Biology (Begley, 3 cr, fall).

BIOBM 485 (=BIOMI 485) Bacterial Genetics (Peters, 2 cr, fall)

BIOBM 633 Biosynthesis of Macromolecules (Roberts/Wilson; fall)

BIOBM 639 The Nucleus (Lis; spring)

BIOBM 641 (=BIOPL641) Lab in Plant Molec Biol (Hanson and van Wijk, 4 cr, fall, in modules).

BIOGD 440 (Stem Cell Biology) (Tumbar, 2 cr, spring)

BIOGD 461 (Development and Evolution) (Wolfner, 3 cr, spring)

BIOGD 483 Advanced Developmental Biology (Wolfner; every other spring)

BIOGD 487 Human Genomics (Clark; fall)

BIOGD 689 Cellular Basis of Development (Liu, 2 cr, fall)

VETMM 705 Molec Mechanisms of Receptor-G Protein-coupled Signaling (Cerione; every other fall)
or other courses with approval by the DGS

Discussion course:

BIOBM 836 Methods and Logic I (Hess; spring)

Please note that there is apparently a long break between the two semesters. However, graduate students are expected to be working on their first or second rotation (see Laboratory Rotations) during the intersession period.

SECOND YEAR STUDENTS

BIOBM 751 Ethical Issues and Professional Responsibilities (Hinkel; spring)

BIOBM 837 Methods and Logic II (Shalloway; spring)

BIOBM 833 Research Seminar in Biochemistry (Vogt/Kraus; fall/spring)

BIOBM 830 Friday afternoon BMCB/GD seminar

THIRD AND FOURTH YEAR STUDENTS

BIOBM 833 Research Seminar in Biochemistry (Vogt/Kraus; fall/spring)

BIOBM 830 Friday afternoon BMCB/GD seminar

FIRST – FIFTH YEAR STUDENTS

BIOBM 732-737, Current Topics in Biochemistry

(All students must take four of these 1/2 credit minicourses during in their first five years. For a list of upcoming minicourses, please go to: http://www.mbg.cornell.edu/mini_courses.cfm.)

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.

CHOOSING A MINOR

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. This list can be obtained from the Graduate School in Caldwell Hall or from the Field Assistant. 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.

Most minors that are chosen by BMCB graduates require about three courses, which students generally can finish by the end of the second year or middle of the third year. Fields often have guidelines, rather than strict requirements, for the number of courses needed to satisfy a minor. It is up to a 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. Below are some notes on typical course loads for minors in the listed Fields.

1) Development (Field of Genetics and Development) - requires two courses in Development (see below) that do not fulfill other course requirements and are beyond BioGD 385. Note that BioGD 385 should be taken in addition to these two courses if a student lacks the appropriate background.

Participation in a weekly Developmental Biology Journal Club is strongly encouraged (see Journal Clubs).

2) Genetics (Field of Genetics and Development) - has no formal requirements; individual course requirements may be specified by your committee members (usually 2 or 3 advanced courses at the 400 level or above and BioGD 281, if necessary).

3) Microbiology (Field of Microbiology) - the requirements for a minor in Microbiology are ultimately up to the discretion of your minor advisor. Generally students are expected to complete at least two of the five one-credit modules in Microbiology (BioMI 690). The Modules in Microbiology include Microbial Structure and Function, Microbial Genetics, Microbial Pathogenesis, Microbial Physiology and Diversity, and Environmental Microbiology.

4) Plant Molecular Biology (Field of Plant Biology) - completion of three 1-credit sections of BioPL 653 and 652 (including BioPL 653, Section 01, Concepts and Techniques in Plant Molecular Biology) with a grade of B- or better, as well as satisfactory completion of two other courses to be selected by the minor advisor in either a plant-related area or in genetics, biochemistry, or cell biology. Satisfactory participation in the Plant Molecular Biology Journal Club for two semesters is also required (BioPL 742, Current Topics in Plant Molecular Biology).

5) Plant Cell Biology (Field of Plant Biology) - satisfactory completion of Plant Cell Biology (BioPl 444) or Survey of Cell Biology (BioBM 432), and the following three 1-credit sections of BioPl 652: Section 5/Molecular Biology of Plant Organelles, Section 6/Proteomics in Plant Biology; and Section 7/Plant Cell Walls: Structure to Proteome) or alternative courses as approved by the minor advisor.

6) Evolutionary Biology (Field of Ecology and Evolutionary Biology) - no specific requirements. Discuss expected background with your prospective minor committee member.

7) Genomics (Minor field) requires BioGD 400, BioGD 401, and two one credit modules in the minor curriculum, or other qualifying courses, as approved by the Special Committee.

8) Biometry (Field of Biometry) - discuss course work with your prospective minor committee member.

9) Computational Biology (Field of Computational Biology)-discuss course work with your prospective minor committee member.

10) Biophysics (Field of Biophysics). Typical requirements are Chem 681 (Physical Chemistry III) and at least two other courses selected from upper level math, chemistry, or physics. Some courses that have been suggested in the past include A&EP 321/322 (math), Chem 686 (Physical Chemistry of Proteins), Chem 789 (X-Ray Crystallography), BioBM 738 (Macromolecular Crystallography), Chem 793 (Quantum Mechanics I), and Chem 780 (Chemical Kinetics). If you are planning a minor in biophysics, *get started on your coursework early!*

11) Physical Chemistry (Field of Chemistry). Similar to listing above for Biophysics.

Other minors that recent BMCB students have chosen include Virology (Field of Comparative Biomedical Sciences) and Organic Chemistry (Field of Chemistry and Chemical Biology). Still other Fields with minors sometimes suitable for BMCB students are Computer Science, Immunology, Applied Physics, Pharmacology.

12) Virology (Field of Comparative Biomedical Sciences).

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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. A rotation evaluation (Appendix II) is turned in to the DGS by the supervising faculty member at the end of each rotation, and these evaluations are discussed by the entire faculty in the Field of BMCB at the spring Field meeting in early June. Along with course grades, the rotation evaluations are used by the Field faculty at this meeting to decide if a student has performed at the expected level for the first two semesters. Students with unsatisfactory grades and/or rotation evaluations will be asked to withdraw from the PhD program (see below).

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. Contact these faculty members as soon as possible to discuss your plans and to work out a schedule for rotation periods (see below). By mid-October at the very latest you should make your plans known to the DGS and GFA, and start the first of three rotations. Usually by the end of the third rotation you will, by mutual agreement with the faculty member concerned, have settled on a laboratory in which to do thesis research. Students who want to initiate a fourth rotation 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.

First Period: mid-October – end of December

Second Period: early January – early March

Third Period: early March – early May

Exact dates will be listed in the orientation material on the "Important Dates for First-Year Graduate Students in the Field of BMCB" sheet.

FIRST YEAR EVALUATION

In early June the BMCB Field faculty meet to discuss the progress of all first year graduate students. Anyone who is judged not to have made satisfactory progress is asked to leave the program. Overall GPA, grades in individual courses, and rotation evaluations all are considered in this decision. Acceptable performance means a GPA of 3.0 (B) or higher in the core courses, no individual grades in the core courses lower than a B- (i.e. no C grades), and no "failed" rotation evaluations. A "failed" rotation evaluation means that the mentor wrote that he/she would not take this student into the lab even if money and space were available (See Appendix II for exact wording). However, since special circumstances sometimes apply, these are guidelines and not strict rules. For example, if a student receives a C+ in a core course but has a GPA over 3.0 and has three good rotation evaluations, most

likely the Field will allow the student to continue. On the other hand, two or more “C” grades are usually not tolerated.

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. They may not continue rotations beyond that time.

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. Most students will be asked to teach during the fall and/or spring term of their second year. The stipend, tuition, and fees for that semester are paid by the Department of MBG. Occasionally, students will teach in their third or later years. The summer before teaching begins, students receive from the DGS 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 DGS tries to accommodate these preferences for teaching assignments, the teaching needs of the department take precedence over individual preferences.

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 MBG Department. Also, sometimes more senior students request TA assignments because their faculty mentors are under financial pressure, for example because a grant renewal was not funded. All of these requests are evaluated by the DGS together with the Chair of the MBG department, who share the responsibility for assigning teaching duties. For requests for TA positions beyond one semester, BMCB students working with Field faculty who are members of the Department of MBG are given preference over BMCB students working with Field faculty who are members of other departments.

The minimum one-semester TA requirement was newly established in 2006, having replaced a two-semester requirement that previously had been in effect for decades. In making this important change, the BMCB Field and the MBG Department made the assumption that there will be a sufficient number of graduate student applicants for TA positions (beyond the one semester requirement) to fill the department’s need for TAs. **However, if in some year there are too few applicants for extra teaching assistant positions to fill the department’s TA needs, the Field, acting through the DGS, may require BMCB students to teach two semesters.**

International TAs are required by the University to have an interview by the International TA Training Program (ITATP) to assess competency in English. In most cases, students from non-English speaking countries are required to take an additional course, given by the ITATP, during their second year to improve teaching skills. Occasionally, students may also be required by the ITATP 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.

MONDAY GRADUATE STUDENT SEMINARS (BioBM 833)

These seminars are held at 12:30 pm every Monday in G10 Biotechnology Building. All graduate students in their 2nd, 3rd, and 4th year must register for this course (BioBM833, S/U, 1 credit). All graduate students in their 2nd, 3rd, 4th, 5th, and 6th years must give a yearly seminar to present their research progress. 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. The most senior students present first, starting at the beginning of the fall semester. Any student who would like to change his/her seminar date (or cancel because of scheduled graduation) should contact the DGS or the faculty member in charge of the course. 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 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 and to help them choose a lab in which to work.

At least two weeks before your seminar, email your seminar title and a one paragraph abstract, including a recent reference or two, to Diane Colf, GFA (dmc18@cornell.edu). She 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.

You should use the sound system in G10 Biotech, as the ventilation system often comes on during talks and can drown out the speaker's voice. The sound system (including the microphone) is stored in the podium. The remote control for the projector is built into the podium. Please pick up a fresh 9-volt battery for the microphone and a laser pointer from the 107 Biotech main office. The department's laptop computer is automatically reserved every Monday from 12 noon-2:00pm for these seminars, so you may pick it up from the main office during that time. Please note that if you would like to use the laptop on an earlier date to practice for your seminar, you should reserve it in the main office as soon as possible, since it is heavily used.

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

OTHER SEMINARS

The Friday MBG Seminar is held at 4:00-5:00pm every Friday during Fall and Spring semesters, and occasionally during the Summer, in the G10 Biotechnology Building Conference Room. These 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 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 department web site for more information: http://www.mbg.cornell.edu/Journal_Clubs.cfm.

- **Bacterial Genetics Journal Club** –Steve Winans, scw2@cornell.edu
- **Cell Biology Journal Club**-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 which are also attended by students doing rotations in those labs.

PROGRESS REPORTS

An annual Progress Report (Appendix V) is required of all graduate students in the Field of Biochemistry, Molecular and Cell Biology. It is used by the Field to monitor progress for purposes of award nominations, graduate school fellowships, department teaching assistantships, and selection for competitive slots on the NIH training grant. The Graduate Field Assistant will give you the Progress Report form at the beginning of the Fall semester and again the month before your seminar. It should be completed by the student and given to his/her Special Committee members one week prior to the student's Monday seminar, as all BMCB students are required to meet with their Special Committee after their Monday seminar. This meeting should take place as soon as possible after the seminar, and certainly within two weeks. Your advisor will write a letter evaluating your progress and discuss it with you. You will then turn in the letter and the Progress Report to the Graduate Field Assistant.

While the faculty attending the June Field meeting primarily discuss first year students, anyone who appears to be making slow progress toward the degree or to be having other problems also is discussed. Results of the evaluation are communicated to first year students by the DGS and to all other students by their advisor.

CONFLICT RESOLUTION

If you have any kind of problem with your major professor that you cannot resolve by talking with him/her, then you should discuss the problem with one of your committee members or with the DGS. If you need further assistance, the Office of Ombudsman is a potential resource (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 Field chosen by the student. This exam has both written and oral components.

Some procedural details

The A exam must be taken by the **end of the fall semester 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 **September 1 of your third year**. This form must be signed by the three members of the Special Committee and the Director of Graduate Studies. If the exam is not taken by the end of the fall semester, you will be allowed to register for the spring semester only after writing a plan for taking the A exam and obtaining signatures from your committee members.

Course requirements for the major (including BioBM 751 "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 ask a fourth faculty member to read the proposal and attend the examination. This person is NOT officially a member of your committee, and should NOT sign the Schedule of Examination form or the Results of Examination form. The fourth faculty member is normally a member of the Field of BMCB but need not be; if you decide to invite someone other than a Field member, check first with your major professor.

You should give a hard copy of the written proposal to each member of the examination committee at least **a week before** the oral 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 which is based on the guidelines for NIH postdoctoral grant proposals.

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)**, including 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. **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 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,

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.

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 or 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.

The committee member representing your minor subject area represents a special case. This person has the responsibility to ascertain that you have achieved competency in that subject area, and the topic of the research proposal may not afford a good opportunity to do this. We recommend that you meet with the person in question, and determine prior to the A exam how he/she suggests you prepare. Some committee members representing minor subject areas may ask broadly-based questions on very basic concepts, whereas others may address a more narrow area and ask the candidate to be prepared for questions in that 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.

General advice on writing the proposal:

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 dialectics² 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 should not put off taking an A exam for want of more data. Preliminary data is 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.

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, so 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

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....."

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.

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 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

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.

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.

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 sentences⁹ 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 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!

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.

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 were established"; "The blot was hybridized with nick-translated probe from clone X"; "Smith et al. cloned 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. showed that the fms oncogene has 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. 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.

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 be 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 three-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. Pass conditional on rewriting the proposal. This option will be exercised when the committee judges that the proposal and the defense are adequate but that some aspect of the proposal needs to be improved. The committee may specify that the entire proposal or that parts of it need to be revised. Some reasons for revision are:

- a. The writing needs to be improved (for example, grammar, clarity, or logical flow of ideas).
- b. Some aspect of the science needs to be rethought (for example, better controls, more cautious interpretation, or more detailed description).
- c. 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. The extent to which the major professor wants to be involved in the rewriting is up to him/her.

- 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 some question concerning the motivation or ability of the student to complete the Ph.D. program, it will usually 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 this: everyone in this field wants you to succeed.

THESIS

When it comes time to begin preparing your thesis, visit the Thesis Advisor's Office (125 Caldwell Hall) and obtain the appropriate packet (Advanced Degree Requirements for the Master's/Doctoral Degree). The packet contains essential information concerning degree deadlines, scheduling exams, thesis format, etc., as well as the necessary forms (e.g., "Schedule of Final Examination" and "Approval of Thesis Form"). Also, at that time, check with the Records office to verify the make up of your committee and to verify that the Graduate School has a confirmation of your undergraduate degree.

At least 7 days before the examination be sure to bring to the Graduate School and GFA the Schedule of Final Examination form (signed by your committee members and the DGS) and the 5x8 Degree Information card.

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 three times a year 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.

Traditional Thesis

Literature Review
Material and Methods
Results
Discussion
Conclusions
Literature Cited
Appendices

Independent Chapter Thesis

Chapter 1: General Introduction and Literature Review
Chapter 2:
Introduction
Materials and Methods
Results
Discussion
Literature Cited
Chapter 3:
(as above)
Final Chapter including
General Discussion,
Speculations 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.

There is a collection of theses in the Elizabeth Keller Reading Room (G09 Biotech). You might want to look at some recent ones as examples. When final copies are made of your thesis, please make an extra bound copy for this thesis collection. Please give the copy to the GFA who will put it in the 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, have the scheduling form signed by all the Special Committee members and the DGS, and present this signed form to the Graduate School. The GFA should also receive a copy of the schedule form at this time along with the title and abstract for the thesis seminar.

MASTERS DEGREE

The Field of BMCB does not have a formal Master’s degree program. In cases in which a student decides that the BMCB Ph.D. program does not meet his or her needs, or in which a student is judged to be unqualified for the Ph.D. program, the Special Committee typically recommends that the student write up and defend the research work he/she has done for a Masters degree. The requirements for a Masters 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 Masters 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. To take the Masters degree path, the student must submit a Change of Program form to the Graduate School, requesting transfer from the PhD program to a Masters program. This form will then be sent to the DGS for approval.

In the past some students have switched to a Masters degree program, successfully defended the thesis, and then switched back to the PhD program (also requiring DGS approval). This is a workable arrangement if the thesis advisor agrees that the student may continue. If the student wants to switch to a different lab after the Masters, then the new thesis advisor must approve and sign a new Special Committee form, and agree to support the student. Occasionally students want to take a leave of absence after completing the Masters degree, with the option of later returning to the PhD program in a new lab. This path is NOT recommended. Historically, without other knowledge faculty assume that students who take a Masters degree are weak (in motivation, independence, intellectual or research ability, etc). Once the student is away on leave, he/she cannot return to the PhD program without financial support, and faculty are unlikely to commit to supporting a student who has not rotated in the lab. Therefore, if a student plans to take a leave of absence after completing a Masters degree, he/she should make any arrangements to return to the PhD program before leaving.

GRAD STUDENT LIFE

Two student representatives are selected each year from the second year class. While the DGS may coordinate this process, the students are entirely responsible for picking their reps. The DGS may ask third and fourth year classes also to pick a student representative. 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 (usually the first Wednesday or Friday after registration) 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 social hour every Friday afternoon after the seminar hosted by various labs in the Biotech Building. Come and meet other students, faculty and staff and wind-down from the busy week.

A **Holiday Party** is held in December for the MBG department and all field students. Information will be sent with details in early December. A dessert contest, entertainment by faculty, staff, and students, and plenty of food make this a fun celebration.

The one-day **MBG Retreat** is held once a year in various locations outside of Ithaca (in recent years at the Geneva campus). The event is part science and part social. During morning and afternoon sessions MBG faculty and in some cases post docs give half hour talks on their research. Typically an outside speaker who is a former BMCB or GD graduate student is invited to make a presentation on his or her career path. Lunch is provided. While the retreat is sponsored by the Department of MBG, all BMCB and GD Field students and their mentors are welcome, even if they are not associated with MBG.

Intramural sports are a great way to get to know people. Look for sign-up sheets on bulletin boards around the building and ask your fellow students.

Women's intramural hockey

Women's intramural inner tube water polo

Coed volleyball

Coed softball

Basketball (occasional)

Also, there are many running clubs. One that is particularly enjoyable is the Ithaca Hash House Harriers, whose members engage in running over rivers and through woods, and at times, even through shopping malls. Finally, there's a strong interest in Ultimate Frisbee - both casual and competitive.

The **Big Red Barn** is a place to eat, socialize and meet other graduate students. You can reserve space there at no cost for professional or social activities. Also, be aware that the Student Life Union at Willard Straight Hall will provide money to student groups who want to sponsor activities involving students.

The **Graduate and Professional Student Assembly** is a major forum for discussing and implementing actions that affect graduate students.

Grads for Grads is a student-run organization that works to create a social and community atmosphere among the entire graduate student population. They sponsor occasional parties and dances.

The **Graduate Advocacy Organization (GAO)** is an organization of graduate students that concern themselves with being a voice for graduate student rights on campus. You can make contact with this organization at PO Box 57, Willard Straight Hall.

A **Women in Math, Science and Engineering Conference** is usually held every year on campus. The conference, organized for girls in the 6th- 8th grades, is organized and staffed by women graduate student volunteers. Watch for notices. This activity provides a good way to meet other women in math and science and to share experiences with others interested in education and teaching.

Cornell Women in Agriculture and Life Sciences has informal meetings once a month at which issues are discussed such as getting a job, mentoring, dealing with a family and a job, etc.

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 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).

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; forms can be obtained from the GFA in 107 Biotech. Checks may be picked up in 107 Biotech. The first check should be available on August 31. Students must be registered and have a completed I-9 form to receive a check.

Method B

The student is on a fellowship, either university fellowship or supported by a departmental fellowship (the BCMB and Genetics 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. Most stipend checks should be available at 143 Caldwell, after registration. Checks are released to registered Cornell students presenting a valid Cornell ID. Taxes ARE NOT withheld from fellowship checks and you are responsible for paying estimated taxes on your taxable income. If you need a form 1040-ES worksheet to help you figure your estimated taxes, please pick one up from the GFA, 107 Biotech. If you are supported during the summer months from a fellowship, you will receive a check in mid-June and early July.

Tuition Payments

Tuition payments are made through the Student Financial system. Fall tuition is credited by September 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 Diane Colf, GFA (dmc18).

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 Diane Colf, GFA (dmc18) 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 for 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, contact the Fellowship Office in Caldwell Hall. Applications must be made by the first day of the month before the date of the conference (see deadlines on application) to allow review by the Graduate Student Screening Committee. The form requesting conference travel support must be signed by the DGS.

AWARDS

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 each make one award annually to a BMCB graduate student for excellence in teaching. The DGS solicits nominations from faculty of their top teaching assistant of the past year.

The LPS Award was established by Frank Melecca, 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

BUILDING SECURITY

Biotechnology is a secured building. It is locked at 5:00pm Monday-Thursday, 4:00pm on Friday, and all day on the weekend. Please help keep the building secure in the following ways:

1. If anyone sees or hears anything suspicious (no matter how minor) please take the time to report it to Public Safety (5-1111).
2. If you see someone in the facility who may not belong — report it.
3. Public Safety 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.
4. 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. Dick Clark (Building Coordinator, Rm. G40, 4-4583) has an engraver he will loan you and he will explain to you how to mark items to deter theft.
7. Report any building security or safety issues to Dick Clark.

BIOTECHNOLOGY PROGRAM CENTER FOR ADVANCED TECHNOLOGY BIORESOURCE CENTER (BRC) (ROOM 170)

The Biotechnology Program, one of 13 NYS Centers for Advanced Technology, operates a Core Facility in the Biotechnology Building. The BioResource Center (BRC) consists of several integrated facilities:

DNA Services

-DNA Sequencing

-Molecular Marker Analysis

-Oligonucleotide Synthesis

Protein Sequencing

Amino Acid Analysis

Computing Services

Microscopy and Imaging

Mass Spectrometry

Molecular Typing (Riboprinting)

Custom Services (HPLC, purification) and consulting are also available.

For more information please see the BRC web site: <http://brcweb.bio.cornell.edu>

CENTER FOR ADVANCED TECHNOLOGY IN BIOTECHNOLOGY FLOW CYTOMETRY AND IMAGING FACILITY (ROOM 160)

This facility provides research support to students and faculty with applications in flow cytometry, confocal microscopy, video microscopy and fluorescence analysis. Two flow cytometers are available (Coulter Profile and 753 Sorter) for a variety of applications including DNA quantitation and cell cycle analysis. Our MRC600 Laser Scanning Confocal Microscope is mounted on a Zeiss Axiovert 10 and equipped with an Argon-Krypton laser. The video imaging system is a silicon intensified video camera on a TracorNorthern image processor and Nikon Diaphot. The spectrofluorometer (SLM 8000) may be used for a variety of fluorescence analysis applications. For assistance phone 254-4862.

BUS TRANSPORTATION

The bus lines that serve Cornell University and the surrounding counties (Chemung, Cortland, Schuyler, Tioga and Tompkins) are: TCAT and Chemung Transit. There is also a Blue Light bus service operated by TCAT that runs from 5:45 p.m. to 1:25 a.m. Monday through Sunday. Students can also purchase an OMNI pass from Transportation Services (5-4600). Schedules for all TCAT bus services can be obtained from the Information and Referral Center in Day Hall or at their web site: <http://www.tcatbus.com/>.

COMPUTING RESOURCES

Laboratory and Office computers in the Biotechnology Building are attached to an ethernet network with connections to the campus backbone and the internet. In addition to the resources in the individual labs, there are shared departmental resources such as printers. Several computers and a printer are available in the Keller Reading Room to access on line journals and print class assignments. Accounts that allow use of this facility can be obtained from Diane Colf, GFA. In addition, Red Rover Wireless is available throughout the common areas of the Biotechnology Building.

ELECTRONIC SHOP

Ron Wolverson (rjw6@cornell.edu) and his assistant are housed in the Biotech Building, room G55, and are employed by the department to repair electronic equipment. Call and leave a message on their machine (5-4733) and one of them will be in touch with you within 1-2 days.

FAX MACHINE

There is a fax machine located in the Department of Molecular Biology and Genetics Mailroom (Rm. 107) for business-related use only. The number for incoming faxes is 607-255-6249. Make sure that your name and lab address are clearly indicated on faxes sent to you. For outgoing faxes, use your phone authorization code as you would for your lab or office phone (see TELEPHONES).

FEDERAL EXPRESS

Federal Express picks up packages from the building each weekday. Packages must be taken to the Receiving Office in Rm. B90 Weill Hall before 3:00pm on the day you want them sent. Necessary labels and envelopes are available there. UPS service is also available; ask for details.

All international shipments (Federal Express and UPS) must have a phone number or the package will be delayed. **ALL** dry ice packages **must** have a phone number or they may not be sent by carrier.

KEYS

You will need to get keys (with a \$5.00 deposit per key) for the building and lab in which you work. Please see Steve Sparling in Rm B90 Weill Hall to get your keys. The exterior door key unlocks the entrances to the Biotechnology Building and the Keller Reading Room on the ground floor (Rm. G09). Talk to your faculty advisor if you need additional keys as only he or she may request them. You will also need to have your Cornell ID card's proximity chip activated to access the interior doors of the Biotech Bldg. 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 (see BUILDING SECURITY). Keys must be returned to Dick Clark before you leave Cornell. Note that there is a \$5 fee to replace a lost key.

LOST AND FOUND

Any inquiries, as well as items found, should be directed to the Receiving Office in Rm. B90 Weill Hall.

MAIL

Mailboxes are provided for all students in the Mailroom adjacent to 107 Biotechnology Building (see Diane Colf in room 107 for more information). All incoming mail addressed to you at the department should indicate "Biotechnology Building" and use the zip code 14853-2703. Mail without the building name may be delayed. The mailroom is intended for University and "business" mail only — please use your residential address for personal mail.

Report all address changes immediately to Diane Colf. This includes your forwarding addresses when you leave Ithaca. It is **your responsibility** to file appropriate change of address forms with journals, etc. when you relocate.

Outgoing US and Campus mail are processed in the Mailroom. Campus mail is a campus-wide distribution system that uses small and large brown envelopes. Ask other students or staff where to get them and how to use them.

Mail pickup and delivery schedule for the Biotechnology Building:

	Approx. Pickup Time	Approx. Delivery Time
Campus Mail	9:00am	10:45am
US Mail	11:30am	2:30pm

There is a US Post Office Substation in the basement of the ILR Conference Center where you can purchase stamps, etc. Their hours are M-Th 8:00 am-4:15pm, F 8:00am-3:45pm.

Please keep the mailroom looking neat and pick up after yourself.

PARKING

Information about parking may be obtained from the Traffic Bureau (116 Maple Avenue, 5-4600). Graduate students are eligible for a parking permit for K lot (Kite Hill, just a few hundred yards from the Biotechnology Building), but the permits are expensive. Some people prefer to park in nearby residential areas and walk to campus or to purchase a TCAT bus pass. With some exceptions, parking after 5:00pm is unrestricted and free.

PAYCHECKS

Graduate students who are paid from the BMCB Training Grant and Graduate School Fellowships pick up their paychecks on the first working day of each semester from the Graduate School Fellowship Office (143 Caldwell Hall). GRAs and TAs are paid semi-monthly and checks are mailed to their home address. Check with Diane Colf about your first payday. You are strongly encouraged to use direct deposit.

PHOTOCOPYING

There are photocopiers on the 2nd, 3rd and 4th floors, as well as in the ground floor Keller Reading Room. A larger and faster machine is available during working hours in the mailroom. You will need an access code to operate these copiers. All copiers accept the same access code. Your major professor will provide the code for your lab. First year students should get a number from the GFA to use until they settle into a lab.

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.

READING ROOM

Located on the ground floor of the Biotechnology Building (Rm. G09), the Elizabeth Keller Reading Room offers a quiet place to read the latest journals. In addition, the reading room has a complete collection of reference books including Peterson's Graduate Programs in Biology and serials such as Methods in Enzymology and the various Annual Reviews plus other reference volumes. Material is **NEVER** to be taken from this room, except that biographies in the Keller collection can be signed out, and each user is responsible for shelving books and journals after use. A photocopy machine is provided in the room.

There is a computer with Current Contents available for literature searches. In addition, files are maintained of postdoctoral opportunities and job opportunities.

Since the librarian only works a few hours twice a week (shelving new journals and preparing journals for binding), every user must take responsibility for reshelving journals and maintaining order.

TELEPHONES

There is a telephone in each lab for the use of staff and students. Long distance phone calls cannot be made from these phones without an authorization code and each lab is assigned its own code. Ask your major professor or the staff in the lab for your code. This authorization code may be used from any phone on campus, **but it is only to be used for Cornell business purposes**. Personal calls should be made from your home phone, if at all possible, but if you do use a phone (or Fax) in the building for a long distance call, you must use your own personal calling card.

THESES FROM FORMER STUDENTS

The Elizabeth Keller Reading Room (Rm. G09) contains a collection of theses completed by recent graduates in the Field of Genetics and Development and the Field of Biochemistry, Molecular and Cell Biology. Full collections are maintained in Mann Library.

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 30 years, in the recent past enrolling about 12 – 22 PhD students per year. There are about 50 faculty in BMCB, somewhat over 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).

***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 has its traditional and administrative home in the Department of Molecular and Cell Biology (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. Such applicants 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, with the only difference being the route by which they joined the Field. 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. All faculty are expected to participate equally in administrative activities, Field committees, and graduate student recruitment and mentoring. All faculty are expected to give a 0.5 credit, 700-level “minicourse” ca. every 8 years.

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 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 all 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 asked to contribute this amount to the Field of BMCB, which will cover the costs as they are incurred. 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.

BMCB ADVISORY COMMITTEE

The DGS appoints an advisory committee to provide advice in Field matters. The committee is broadly representative of research areas and departments.

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 600-level, but some 400-level courses may be appropriate, e.g., BioBM437 or BioBM439). Appropriate courses in BMCB include: BioBM631, 632, 633, 636, and 639. 600- and 700-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 BioBM440.

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.

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. In particular, the Department of Molecular Biology and Genetics is unable to guarantee subsequent support for students who choose to work with faculty outside the department. Field faculty members must agree not to subsequently put the student on other training grants without prior approval from the NIH administrators of the Cellular and Molecular Biology training grant, obtained in consultation with the CMB training grant PI (John Lis). 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.

OTHER COMMITMENTS IMPLIED BY FIELD MEMBERSHIP

All Field members are expected to serve as advisors on student's Special Committee representing BMCB, to teach one of the Current Topics in Biochemistry minicourses at least once every ca. 8 years, to serve on committees (such as the Admissions Committee), and to occasionally organize 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 (Appendix V) 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.

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 II), 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.

STUDENTS WHO ENTER OUR PROGRAM 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 BioBM831 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 (BioBM833) 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 G10 Biotech, the large conference room on the ground floor. 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

ROTATION EVALUATION FORM

Field of Biochemistry, Molecular and Cell Biology

TO: Rotation Mentors
FROM: Volker Vogt, DGS
RE: Rotation Evaluation Request

Please fill out the attached rotation form and discuss with the student, PRINT OUT WITH YOUR COMMENTS, and return the original, signed by both you and the student, to Diane Colf (107 Biotech Bldg) immediately after the rotation period. NOTE THAT THIS FORM IS REVISED FROM PREVIOUS YEARS. If the student is no longer in your lab, please return the form and we will obtain the signature.

If you have any confidential comments, use the space below or write a letter or send an email.

Careful evaluation of our first year students is an essential component of our graduate program. These materials are critical for their evaluation at our annual field meeting in May or June.

Field of BMBC ROTATION EVALUATION FORM

Confidential comments (*optional*):

Field of BMBC ROTATION EVALUATION FORM

Rotation Student: _____ Professor: _____

Rotation Period Dates: _____

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 students taking courses: A or B grades are acceptable; C or lower grade are not acceptable except under special circumstances.*

_____ 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.**

Mark which of these statements is correct and explain:

_____ 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.

_____ I might be willing to take this student into my lab, assuming he/she were interested and assuming I had space and sufficient financial support, but I have significant reservations (Explain any reservations).

_____ I would not be willing to take this student into my lab, even if I had space and sufficient financial support. (Explain).

Comments (*use separate page if needed*):

Faculty Signature _____ Student Signature _____
Date: _____

APPENDIX III

PLANNING FOR A POSTDOCTORAL POSITION

1. Timing:
 - Begin looking during your 4th year; 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.

4. Sources of postdoctoral funding:
 - In addition to a list of postdoctoral positions, the Reading Room has a file containing information about fellowships and other sources of funding.
 - The Sponsored Programs Library can search for specialized fellowships (115 Day Hall, 5-2949).
 - 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.

APPENDIX IV

SOME FOUNDATIONS THAT AWARD POSTDOCTORAL FELLOWSHIPS

Consult the websites of these foundations for details about fellowship applications.

- 1) American Cancer Society
- 2) Damon Runyon-Walter Winchell Cancer Fund
- 3) The Jane Coffin Childs Memorial Fund for Medical Research
- 4) Life Sciences Research Foundation
- 5) The Helen Hay Whitney Foundation
- 6) NIH, NRSA
- 7) Arthritis Foundation
- 8) Juvenile Diabetes Foundation International
- 9) Leukemia Society of America
- 10) Muscular Dystrophy Association

APPENDIX V

2008-2009 Evaluation of Student Progress by the Special Committee for the Field of Biochemistry, Molecular and Cell Biology

(To be completed by Special Committee Chair)

Please provide an account of the student's progress over the last year, listing any recommendations made by the Special Committee to the student, and detailing any problem areas. This report is due within 30 days of the annual student seminar. Use additional pages if necessary. Student must sign the completed form to acknowledge its contents.

Student's Name _____

Chair's Name _____

Member's Name _____

Member's Name _____

Chair's Signature Date Student's Signature Date

Please return to Diane Colf: 107 Biotechnology Building

2008-2009 Progress Report for the Field of Biochemistry, Molecular and Cell Biology

(To be completed by Student)

Student's Name: _____

Date of First Cornell Registration: _____

Date "A" Exam Scheduled or Passed (circle one): _____

Describe your research using the following headings. Use continuation pages if necessary.

1. Dissertation project description:
2. Status of research as of last report (2006-2007):
3. Progress since last report (to present):
4. Research goals for this year:

Please return to Diane Colf: 107 Biotechnology Building

2008-2009 Progress Report (continued)

Publications since last report:

Titles and dates of talks, seminars and posters presented last year (since last report):

Awards/Honors received last year (since last report):

Other professional activities (outreach, etc.)

For Students in or beyond their 4th year:

Planned graduation date: _____

Date of Thesis Seminar: _____

Post-graduation plans, if known:

Please return to Diane Colf: 107 Biotechnology Building

Post-Special Committee Meeting Report

(To be completed by Student)

Student's Name: _____

Seminar Date: _____

Special Committee Meeting Date: _____

Ph.D. Committee Members	Area	Attended Seminar		Attended Special Committee Meeting	
Chair: _____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Minor: _____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Minor: _____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Additional: _____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Invited Faculty Members	Area	Accepted Invitation		Attended Seminar	
Invited faculty: _____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Invited faculty: _____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Signature of Student

Date

EMERGENCY NUMBERS

<u>Problem</u>	<u>Resource</u>
EMERGENCY Fire, Police, Ambulance	911
Non-Emergency Public Safety	5-1111
Building Emergencies	Dick Clark, Building Coordinator 7:00am-3:00pm (4-4583) After Hours Mechanic (5-5777)
Medical Problems	Gannett Clinic (5-5155)
Chemical Questions Radiation Spills or Problems Respiratory Protection Right-to-Know (Toxic substances) Toxic Waste Disposal Problems	Environmental Health & Safety (5-8200)
Security	Public Safety (5-1111)