

MANUAL FOR GRADUATE STUDY
in the
CELL AND MOLECULAR BIOLOGY PROGRAM

College of Natural Science
Michigan State University

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PLEASE KEEP FOR FUTURE REFERENCE

CMB MANUAL FOR GRADUATE STUDY
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1. INTRODUCTION

The **Manual for Graduate Study** contains directives, regulations and policies that pertain to the Cell and Molecular Biology Program (CMB) in the administration of graduate education. With contributions by the faculty and graduate students, the **Manual** is a reference document for graduate education in CMB. It is not a substitute for the Graduate Catalog of the University. The objective of the **Manual** is to provide working guidelines, yet permit reasonable changes and interpretation.

The objective of the graduate program in CMB is to provide training opportunities in contemporary cell and molecular biology to qualified students. The major emphasis of the Program is on training students for the Doctor of Philosophy degree with a primary career objective of research and/or teaching. This is achieved by ordinarily accepting students directly into a Ph.D. program, and upon its completion encouraging further research training at the postdoctoral level. The Ph.D. degree is a research oriented degree; the emphasis is on experimental and creative work, and the aim is to enable the student to become a self-educating and original scholar. There are several circumstances in which students would wish to enroll in an M.S. program. Students with limited research experience, or with specific deficiencies in their undergraduate training, may be admitted into the M.S. program in order to obtain additional experience before deciding whether to proceed to the Ph.D. program. In addition, students admitted directly to the Ph.D. program sometimes change their career goals, and wish to transfer to an M.S. program. MSU has the ability to provide excellent M.S. level training in Cell and Molecular Biology, and students who graduate with this degree will be well qualified for a variety of careers.

2. PROGRAM OVERVIEW

The CMB Program is an interdisciplinary, all-University organization of scholars in multiple departments and is administered by the College of Natural Science. The graduate program of a student will be processed through the College of Natural Science. The chief administrative officer of the Program is the Director, who is responsible for the educational, research and service programs, the budget and personnel. The Associate Director is primarily responsible for graduate student affairs, and chairs the Admissions Committee, which is responsible for identifying and recruiting prospective graduate students. The director and associate director are assisted by the Executive Committee, which establishes program policies and procedures. The Program is regulated by Bylaws which are procedures by which the CMB faculty and graduate students participate in the academic governance of the Program. Copies of the Bylaws are available in the Program office, located in room 2240A Biomedical Physical Sciences Building.

3. PROGRAM COMPONENTS/PLAN OPTIONS

3.1 Degree Programs

Graduate study leading to the Doctor of Philosophy degree and the Masters of Science degree is offered by the Program. Graduate study concurrent with professional education is possible for students in human medicine, osteopathic medicine, and veterinary medicine.

3.2 Doctoral Training Program

The educational objectives of the Ph.D. program are to provide doctoral students with the fundamental knowledge and research skills so that they may become independent and self-educating scholars. Students normally take a minimum of 5 required and elective lecture courses during their first two years. In addition, students are required to participate in CMB seminar classes and research forum. The detailed course of study is decided in consultation with a Guidance Committee composed of five faculty members and usually chaired by the thesis advisor/research mentor.

During the first two semesters, students participate in ten-week rotations in three laboratories of interest before selecting a thesis advisor. After choosing a thesis advisor, a guidance committee comprised of 4 – 5 regular MSU faculty is formed. At the end of the second year, each student writes a research proposal and defends it before an examining

committee. This constitutes the comprehensive examination for the Ph.D. degree. Thereafter, research progress is evaluated annually by the Guidance Committee. Usually at least five years are required to complete the requirements for the Ph.D. degree.

As an integral aspect of their training, doctoral students participate in teaching for at least one semester (see section 4.3 F). Student participation in program affairs, including standing or ad hoc committees, is encouraged. Weekly seminars sponsored by several departments provide opportunities to learn about current discoveries by leading scientists from around the nation and the world.

3.3 Masters Training Program

Students in the M.S. program must earn a total of 30 credits, which must include core courses in Molecular Biology, Cell Biology, and Genetics. For a Plan A master's degree, students must complete a minimum of 4 and a maximum of 10 credits of CMB 899, Master's Research. They must also prepare a written thesis, and complete a final research seminar and oral examination. For a Plan B master's degree, students may complete a maximum of 8 credits of CMB 890, Independent Study. They must also complete a final report and oral examination, but no thesis is required. Students in the M.S. program will be directed by a Guidance Committee, which must contain at least 3 regular MSU faculty members. Two of these members must be members of the CMB program. This guidance committee will be formed by the end of the second semester in the M.S. program, and will meet at least annually. The guidance committee will also conduct the final oral examination. Students in the M.S. program may or may not participate in teaching.

3.4 PH.D. Program Concurrent With Professional Medical Program

The CMB Program encourages the development of concurrent Ph.D.-D.V.M., Ph.D.-M.D., or Ph.D.-D.O. programs for the exceptional professional student interested in academic medicine. Unless stated otherwise, the existing directives and requirements for the doctoral program will be followed for students in the concurrent programs. These students must also fulfill requirements of their professional program in the College of Human Medicine, College of Veterinary Medicine, and College of Osteopathic Medicine unless stated otherwise to accommodate existing policy of the colleges.

4. DEGREE REQUIREMENTS

4.1 Admissions

All applications for admission will be considered by the admissions committee which will consider the applicants transcripts, supporting letters, statement of purpose, GRE and TOEFL scores, etc. Most students are admitted to the Ph.D. program directly from the B.S. level without earning an M.S. degree, although applicants having an M.S. degree are also considered. In cases where an applicant's previous experience is deficient in a specific preparatory course, the applicant may be granted provisional admittance to the Ph.D. program. The specific courses to address the deficiency shall be defined in the letter of admission, and the deficiency shall be rectified within the first year of the graduate training period.

A student who obtains an M.S. degree from this Program may not enter the Doctoral program until his/her M.S. thesis is complete and accepted, and then only with the written recommendation of his/her M.S. Guidance Committee, the Program Director and the Admissions Committee. Similar recommendations and approval are required for a student who enters the M.S. program but then aspires to the Ph.D. program without obtaining an M.S. degree. In either case, a request for transfer to the Ph.D. program must be submitted by the student in writing to the departmental Admissions Committee, which will treat the request as a new application. The original graduate application should be updated with respect to transcripts, supporting letters, statement of purpose, etc. Evaluation of the acceptability of the applicant to the doctoral program will be based in part on the availability of funds, consideration of the student's qualifications and potential in competition with other current applicants, and the availability of a professor who will consent to be the research advisor.

4.2 Language Requirements

Applicants without full native fluency in English must fulfill proficiency requirements as part of admission. More information is available from The Graduate School (www.grad.msu.edu). International graduate students are also required to participate in the International T.A. orientation program sponsored by the University.

4.3 Ph.D. Degree Requirements

- A. Course Requirements:** Students entering the doctoral program will be advised by the program director or associate director in the selection of courses for the first year. The following three courses are required of all students:

BMB 801 - Molecular Biology
BMB/MMG/PSL 825: Cell Biology
Either MMG 833 (Microbial Genetics) or MMG 835 (Eucaryotic Molecular Genetics)

In addition, students are required to complete a minimum of two elective lecture courses at the 800 level to be chosen from a list of approved electives (see appendix). Exceptions to these requirements are based on satisfactory performance in graduate-level courses of similar content. Requests for a waiver from a required course must be approved by the CMB Program Director after consultation with the instructor in charge of the relevant required course. Students are expected to enroll for a minimum of 6 credits per semester during the first year, except the Summer term, when 3 credits is the minimum.

Enrollment for a minimum of 24 dissertation research credits (CMB 999) is required by the Graduate School.

Each student must fulfill the residency and course requirements specified by the College of Natural Science (see *Academic Programs* bulletin).

Time limit. Graduate School regulations specify that all requirements for the Ph.D. must be completed within eight years from the beginning of the graduate program. Exceptions to this requirement must be approved by the Program, College, and Graduate School. The national average for the Ph.D. degree is 5.3 years.

- B. Laboratory Rotation:** CMB students are required to complete three laboratory rotations during their first two semesters in the Program. Laboratory rotations are approximately 10 weeks each and meet several major needs. One is to provide a means for students to work in a focus area, become familiar with major objectives of an area of research, and to learn methods used to probe research problems. The second purpose of the laboratory rotation is to identify a research mentor and to discuss and investigate potential thesis projects with that prospective mentor. Rotations provide an excellent opportunity for students to learn first-hand the research activities of various laboratories. In turn, this is an opportunity for faculty to observe and evaluate the research potential of rotation students, and to interact on a personal level.

Each rotation must be in the laboratory of a different faculty member from CMB or another participating program (BMB, GEN, MMG, PSL, Pharm/Tox). Rotation assignments must be approved by the Program Director or Associate Director in consultation with the student and faculty member. Students have the option to select all three rotations at the beginning of the academic year, or to select appropriate laboratories for additional rotations as the academic year progresses. Students on a half-time assistantship should plan on spending at least 20 hours per week on the rotation assignment. The specific activities in each rotation may vary among laboratories; these activities and expectations should be defined at the outset by the faculty member. These activities are likely to include reading background and project-specific scientific literature; design, execution and analysis of experiments; discussion of research project opportunities; interactions with other lab members; and presentation of the rotation project effort at a lab group meeting. A written report on the research competence of the rotation student will be prepared by the rotation professor, discussed with the student, and submitted to the CMB Graduate Office. These rotation evaluations become a part of the student's academic record. If the student

wishes, he or she may write a response to this evaluation, and this response will be added to their file. Students may enroll for credit for rotations, on a pass/no pass basis.

- C. Required Seminar Courses:** Learning oral communication skills is an important aspect of graduate training in the Cell and Molecular Biology Program. One aspect of scholarly activities is presentation of scientific material both to peers and students at various stages of their educational experience. Effective oral presentation as an academician is an acquired skill which requires careful preparation and organization. Communicating information verbally with appropriate visual aids is the end stage. By requiring students to enroll in seminar courses, these skills can be acquired and polished. Students are required to take three graduate-level special topics courses. These are listed as CMB 800 and are offered by CMB faculty. Alternatively, these courses may be substituted by comparable graduate-level seminar courses offered by other departments or programs subject to approval by the Guidance Committee and the CMB Program Director. In addition, students are required to enroll in two research seminar courses (1 credit) listed as CMB 892 and entitled "Research Forum." These courses involve presentation of current research by CMB students, are restricted to CMB students, and are offered in the Fall semester.
- D. Ethics Requirements:** All students are required to complete training in scientific ethics. This requirement may be fulfilled by completing an approved course (such as NSC 830) or by participation in a series of responsible conduct of research workshops conducted by the Office of the Vice President for Research and Graduate Studies/The Graduate School.
- E. Comprehensive Exam:** Completion of the comprehensive examination must be achieved, within 7 semesters of entering the Graduate Program (including summers). See section 7 for more details.
- F. Teaching Requirement:** Many graduates of the CMB program will seek future employment as professors in academic institutions and therefore require training and experience in teaching as part of their graduate program. All students in the PhD program are required to complete a minimum of 1 teaching assignment under the direction of a regular MSU faculty member. The faculty member charged with responsibility for the course will serve as a teaching mentor to the CMB graduate student. The faculty mentor will meet with the student prior to the assignment to establish goals and outcomes, and will provide regular feedback to the student concerning his/her performance. At the end of the assignment, the mentor will provide a written evaluation of teaching performance to the student and to the CMB Program Director.

Teaching assignments are made by the Associate Director based upon undergraduate credentials, research experience, areas of interest, and Program teaching needs. Since CMB is a graduate program and does not teach undergraduates, these assignments will be in one of the participating departments, and may involve a laboratory or lecture course. Graduate students assisting in a laboratory course may be provided opportunities for laboratory preparative duties, lecturing, practical demonstrations, and preparation and grading of examinations. Graduate students assisting in lecture courses may present a lecture(s), supervise review sessions, grade assignments, or carry out other duties relevant to the educational experience.

During the semester when they are completing their teaching assignment, students will register for a 1 credit teaching seminar in the relevant department (such as the appropriate section of BMB 961 or MMG 892). In addition, students are encouraged to obtain additional training by participating in various workshops, courses and certificate programs that are available through the College and/or Graduate School. Specific courses that are recommended include SME 870 (Teaching College Science). Students desiring additional teaching experience may apply for positions as Teaching Assistants through specific departments. Students appointed on such teaching assistantships will be governed by the rules of the MSU-GEU collective bargaining agreement (<http://www.msu.edu/~geu/contract/finalcontract.htm>).

- G. Thesis and Final Exam:** Six months prior to the expected completion date, each doctoral candidate must meet with his/her Guidance Committee to finalize plans for completion. See section 8 for details on preparation of the thesis and the final oral examination.

4.4 Ph.D. Program Concurrent with Professional Medical Program

- A. Course and Credit Requirements:** The course requirements are the same as those of the Ph.D. degree. Selected graduate school courses can be waived upon approval of the Guidance Committee, when the required courses in the student's professional curriculum provide adequate exposure to a subject area. Conversely, waiving of a required course in the medical curriculum will be permitted, if allowed by the student's respective college, and if graduate courses provide adequate exposure to the same subject matter. Students in a combined degree program are expected to make satisfactory progress towards both degrees simultaneously. When possible, the student should utilize vacation and elective time to take required graduate courses and conduct research. Unless free or elective time becomes available, students may be requested to stop temporarily their professional studies in order to take appropriate graduate courses and facilitate satisfactory simultaneous progress. For dual degree students, Comprehensive examinations must be taken within 4 years, and all requirements must be completed within 8 years from the time of the student's first enrollment into the doctoral program.

4.5 M.S. Degree Requirements

Students in the M.S. program are required to earn a total of 30 credits. For a Plan A master's degree, students must complete a minimum of 4 and a maximum of 10 credits of CMB 899, Master's Research. They must also prepare a written thesis, and complete a final research seminar and oral examination. For a Plan B master's degree, students may complete a maximum of 8 credits of CMB 890, Independent Study. They must also complete a final report and oral examination, but no thesis is required. Graduate School regulations specify that all requirements must be completed within six years from the beginning of the M.S. Program. Exceptions to this requirement must be approved by the Program, College, and the Graduate School.

- A. Course Requirements:** The following three courses are required of all M.S. students:

BMB 801 - Molecular Biology
BMB/MMG/PSL 825: Cell Biology
Either MMG 833 (Microbial Genetics) or MMG 835 (Eucaryotic Molecular Genetics)

In addition, students are required to complete a minimum of two elective lecture courses at the 800 level to be chosen from a list of approved electives (appendix #14.1). Exceptions to these requirements are based on satisfactory performance in graduate-level courses of similar content. Requests for a waiver from a required course must be approved by the CMB Program Director after consultation with the instructor in charge of the relevant required course.

- B. Required Seminar Courses:** Students are required to take one graduate-level special topics course. These are listed as CMB 800 and are offered by CMB faculty. Alternatively, this course may be substituted by a comparable graduate-level seminar course offered by other departments or programs subject to approval by the Guidance Committee and the CMB Program Director. In addition, students are required to enroll in two research seminar courses (1 credit) listed as CMB 892 and entitled "Research Forum." These courses involve presentation of current research by CMB students, are restricted to CMB students, and are offered in the Fall semester.
- C. Ethics Requirements:** All students are required to complete training in scientific ethics. This requirement may be fulfilled by completing an approved course (such as NSC 830) or by participation in a series of responsible conduct of research workshops conducted by the Office of the Vice President for Research and Graduate Studies/The Graduate School.

- D. Thesis Final Exam:** Plan A M.S. students will prepare a written thesis and have an oral thesis defense. Plan B M.S. students must complete a written report and pass a final oral exam.

5. SELECTION OF THESIS/DISSERTATION ADVISOR

During the first year in the Program, students will be advised by the Director and/or Associate Director. At the end of the first academic year, students will choose a permanent thesis advisor. The thesis advisor is usually a regular faculty member in the Cell and Molecular Biology Program, and serves as the chairperson of the student's guidance committee. For Ph.D. students, the thesis advisor also serves as the student's doctoral dissertation research mentor. In cases where students select a doctoral dissertation mentor who is not a CMB faculty member, a regular member of the CMB faculty will be appointed as a co-advisor and chairperson of the guidance committee.

Factors to consider in selection of the research mentor are i) the research area and its exceptional interest to the student, ii) space in the laboratory and financial support for the student's research, and iii) personal compatibility with his/her research mentor. On the latter issue, a mutual understanding between professor and student is important to promote the development of the student's creative potential and ability to conduct research.

Ph.D. students are expected to defer selection of the research mentor until the middle of their third rotation. M.S. students may select a thesis advisor at any time after entering the program. The selection of a thesis advisor/research mentor is by mutual agreement between the student and mentor. If the student wishes, the Director or Associate Director will assist in selecting a mentor. On selecting the advisor/research mentor, the student will promptly notify the CMB Program Office in writing for approval by the CMB Program Director, and to establish administrative records.

In situations where an advisor leaves MSU or the student needs to change advisors for other reasons, the Program Director/Associate Director will work with the student to identify a new advisor. Together, the student, Program Director/Associate Director and the new advisor will review the appropriateness of the student's plan of study and guidance committee membership, and recommend any necessary changes.

6. GUIDANCE COMMITTEE FORMATION AND DUTIES

The major responsibilities of the Guidance Committee are i) to establish the program of study, ii) to evaluate progress toward the degree on an annual basis, iii) to serve as the Comprehensive Examination Committee for Ph.D. students, iv) to provide guidance and advice in addition to that given by the research mentor, and v) to conduct the dissertation defense/final examination.

6.1 Membership:

The committee is selected from regular CMB Program faculty by the student, with the advice and approval of the research mentor and the Program Director/Associate Director. Selection should be based on the relevance of the faculty member's research interests to the student's dissertation project. For Ph.D. students the Guidance Committee shall normally consist of five members, and must include (i) the research mentor, who usually acts as Chairperson of the Guidance Committee (see section 5), (ii) one member appointed by the CMB Executive Committee, and (iii) faculty from at least two departments. One member may be chosen from outside of the CMB Program. The committee should be selected soon after the research mentor has been chosen, and *must* be formed by 15 months after entering the graduate program. For M.S. students the Guidance Committee shall normally consist of three members, two of whom must be regular CMB faculty. If it becomes necessary to substitute a member of the Guidance Committee, this should be arranged in consultation with the Program Director/Associate Director and research mentor.

6.2 Duties of the Student and Guidance Committee:

- A. **The first meeting:** After the Guidance Committee has been chosen, the first meeting should be scheduled by the candidate and must be held within 15 months after entry into the CMB Program. Four objectives of this meeting must be met before scheduling the comprehensive examination (see 7 below). The first is to review the proposed dissertation research. The student must prepare a written outline of the dissertation research (1-3 pages) that will be submitted to Guidance Committee members at least two days prior to this meeting. This outline will be composed by the student, with advice and consultation from the research mentor. The student will present a short oral description of the dissertation project that includes an introduction to the area of study, a statement of the problem, a brief description of the methods to be employed, and the objectives of the dissertation project.

The second objective is to discuss elective coursework in addition to courses required by the major (appendix # 14.1). Before the meeting, the student should prepare a list of courses taken, and those that are planned with the goal that a comprehensive knowledge of the general field of Cell and Molecular Biology with detailed knowledge in a specialized area will be obtained.

The third objective of the first meeting is to complete the "Report of the Guidance Committee — Doctoral and Other Programs" that will be filed with the Dean of the College of Natural Science. This form is available from the Graduate Programs Secretary, and should be completed by the student and research mentor. This draft, promptly submitted to the Graduate Programs Secretary, will be typed and processed. The final signed document will then be transmitted by the Graduate Programs Secretary to the Dean's Office, with copies distributed to the student and to each member of the Guidance Committee. An example of this form included in the appendix section 14.5.

The fourth and final objective is for the CMB Program Representative or the committee to complete the "CMB Program Yearly Guidance Committee Report" which can be found in the appendix section 14.5.

Requests to delay formulating the Guidance Committee or holding the first meeting because of extenuating circumstances must be approved by the CMB Program Director or Associate Director. If approval for a delay is not obtained, the office of the Dean will be requested to place an academic hold on the student's enrollment.

- B. **Comprehensive Exam:** The Guidance Committee (minus the mentor) will serve as the Comprehensive Exam Committee.
- C. **Annual evaluation of progress:** At 12-month intervals after successfully passing the Comprehensive Examination, the student will schedule a meeting of the Guidance Committee to evaluate progress. The Graduate Programs Secretary will notify each student and each Guidance Committee member of this obligation two months prior to the due date for each annual meeting. The student shall prepare a written annual progress report, normally 5 to 15 pages, summarizing the essence of the year's research progress and future plans, and present a copy to each Guidance Committee member one week prior to each annual meeting. Failure to hold this meeting by the annual deadline will lead to a review of the student's progress in the program by the program director/associate director.

At the annual meeting, the student will present a 10- to 20-minute oral report to the assembled Guidance Committee. The meeting will include discussion of the written and oral report and any other matters relevant to the student's progress in the graduate program. This annual meeting should serve to i) assess the pace and adequacy of progress, ii) provide motivation and opportunity for the student to gain experience in the presentation and defense of his/her work, and iii) provide opportunity for the members of the committee to make suggestions regarding methods, direction and appropriateness of the research plan outlined by the student, and skills in oral and written expression.

The CMB Program Representative to the Guidance Committee is responsible for the preparation of the annual evaluation of the student's progress and also serves as Chair for the Comprehensive Examination. An evaluation form will be supplied by the Graduate Programs Secretary (see appendix 14.5). The evaluation, signed by all members, and the student's annual progress report will be submitted to the CMB Programs Office within one week after each annual meeting. Should a consensus opinion not be reached, minority opinions may be appended to the report. The Committee should also determine if there are any specific additional requirements which the student must meet. If so, a written statement of them, as well as how and on what schedule the student will meet the requirement(s), should be included as part of the annual evaluation. The student must sign the report; if (s)he disagrees with the evaluation, a written rebuttal may be appended and will be reviewed by the Program Director/Associate Director. If serious concerns exist the Director/Associate Director will meet with the student and mentor to address these concerns. The Committee report and appended documents will become part of the student's permanent file. If the consensus of the Guidance Committee is that satisfactory progress toward the degree cannot be achieved, the Program Director shall be informed.

- D. The final examination:** Members of the Guidance Committee will evaluate the dissertation and final oral examination (see section 8)
- E. Other responsibilities:** In addition to the major duties provided by the Guidance Committee that are described above, the student can expect members of the Guidance Committee to provide professional advice on research, career development, and scholarship.

7. COMPREHENSIVE EXAMINATION

The Comprehensive Examination is a mechanism to explore the scientific potential of a Ph.D. student. During this examination, the student is tested on his/her understanding of fundamental knowledge in a specialized area of science, problem solving skills, and ability to pose and test a scientific problem of fundamental importance. The student must demonstrate defensible logic in the formulation of questions and in the attempts or proposals to answer these questions experimentally, as well as a knowledge and understanding of the facts and concepts important to the research.

A student may attempt the Comprehensive Examination if his/her academic performance meets the standards described in section 9, and the initial meeting with the Guidance Committee has been held and officially documented by submission of the signed Guidance Committee report (see section 6.2). The examination must be taken no later than one month after the end of the sixth full semester in the program (including Summer semester). Typically, for students entering the program in August, the deadline is September 30th of the second year.

Satisfactory completion of the comprehensive examination must be achieved, including any authorized remediation, within seven semesters from the beginning of the graduate program, unless an extension is authorized by the Program Director.

7.1 Preparing for the Comprehensive Examination

A fundamental body of information is key to understand a particular field, to communicate with others, and to build upon others' work. Much of this factual knowledge is learned from coursework and from current textbooks. It is the foundation for further learning that is obtained by reading current literature, and attending seminars, laboratory discussions, and journal clubs. These activities also serve to develop problem-solving skills. Careful analysis of experiments presented in a particular article or research presentation, is critical to understand the questions the investigators asked, the general approach and specific techniques used to answer the questions, and to what extent the investigators actually answered the questions. Students should make it a practice to understand articles and presentations in order to add to their body of knowledge and to develop problem-solving skills.

An essential set of tools for an independent research investigator involves the ability to ask significant questions, to synthesize logical hypotheses, to design and execute appropriate experiments to test these hypotheses, and to interpret the

results properly. Thus, a major aim of the comprehensive exam is to determine if the student can pose and solve scientific problems logically and creatively. The exam will also require knowledge of various laboratory techniques used in Cell and Molecular Biology.

The student will set a date for the Comprehensive Examination after consulting with the members of his/her Comprehensive Examination Committee, which is comprised of the Guidance Committee minus the Research Mentor/Thesis Advisor. The written proposal must be submitted to each member of the Guidance Committee one week before the open seminar and oral defense. The CMB Program Secretary will post an announcement of the seminar presentation to CMB faculty at this time.

7.2 Elements of the Comprehensive Examination

Three parts compose the Comprehensive Examination. One is the written research proposal. The second is the oral presentation of the research project. The third involves questioning by the Comprehensive Examination Committee in closed session.

- A. Written Proposal:** Your research proposal should include sufficient information needed for evaluation of the project, independent of any other document. Be specific and informative, and avoid redundancies. The research proposal should be in the following format*, with section lengths approximately as described below. Sections I-IV may not exceed 20 pages (double spaced, 12 point font, margins of no less than 0.8 inches on all sides).

I: Specific Aims (1 page). Describe both the broad, long-term objectives of your research, and what the specific research described in this proposal is intended to accomplish. In most cases, specific aims of the research should be listed in numerical order, with a brief description of each aim. An average proposal will probably contain 3-4 aims. Note that these aims are for your future research.

II: Introduction and Background (3 pages). The main purpose of this section is to put your research in a larger prospective. Give a concise history of the problem, and justify its importance and relevance. Point out the main issues which currently occupy attention in the area, and identify the gaps that your project is intended to fill. Include annotation of cited references.

III: Preliminary Results/Progress Report (5-7 pages). Briefly describe the research that you have done to date. Begin by describing what question(s) you set out to answer, and then present your results. Concisely describe the methods that were used, quoting references for commonly used procedures. Flow charts may be helpful in some cases. Your results may be presented in graphic, tabular, or other form, and may be provided as figures in an appendix (not included in the length limit). All figures and tables should be of good quality, clear, and properly labeled and titled.

Discuss the interpretation of your results. What conclusions could be drawn from them, and what questions were left unanswered? What alternative approaches might be tried, and what further experiments are indicated? Use this as a lead in to the next section.

IV: Experimental Plan (9-11 pages). In this section you should describe the research design and the procedures to be used to accomplish the specific aims of the project. Include how the data will be collected, analyzed, and interpreted. Describe any new methodology and its advantage over existing methodologies. Discuss the potential difficulties and limitation of the proposed procedures, and alternative approaches to achieve the aims. As part of this section, provide a tentative sequence or time-table for the project.

Literature Cited (<50 references). This should include all references cited in the preceding sections, using a standard format of journals relevant to the field. Titles should be included for all references.

Appendix: Include Data and Diagrams referred to in the text. Figure legends should be included, but should not be used to circumvent the page limit.

* Note: Usually the proposed research will be a continuation of the research problem described in the Preliminary Results/Progress Report section. If the proposed dissertation research is clearly unrelated to the student's previous research, then there should be 2 sections. The first should be on the previous research, and contain a brief introduction to the problem (2 pages), plus a description of the research that was accomplished (5-7 pages). The dissertation proposal should then include 3 sections, Introduction/Background, Specific Aims, and Experimental Plan. The total length limit for the proposal in these cases will be extended to 22 pages.

- B. Oral Presentation:** The oral presentation based on the written proposal should be approximately 50 minutes in length. Organization of the seminar will normally include a general introduction, rationale for the proposed research, statement of the problem, preliminary data obtained, proposed experimentation and potential results. Slides and other visual aids are to be clear and of good quality. Announcements of the seminar will be posted by the Graduate Programs Secretary. Either the Research Mentor or the CMB Representative to the Guidance Committee, will introduce the student to the audience. At the end of the seminar, members of the Comprehensive Examination Committee will reserve questions until the closed session that follows.
- C. Closed questioning by the Comprehensive Examination Committee:** The closed session that immediately follows the oral presentation should be scheduled for 1.5-2 hours in a conference room reserved by the student. The Chairperson of the Comprehensive Examination Committee will preside over this portion of the examination. The research mentor will not be present.
- D. Evaluation of Performance on the Comprehensive Examination:** Several criteria will be used to evaluate student performance in the Comprehensive Examination. First, the candidate shall have done a reasonable amount of laboratory or theoretical work, directed toward an original problem, including planning. For some candidates the data may be substantially of the negative type, i.e., data showing what does not occur. Second, the candidate shall make clear to the examining committee that in performing this research (s)he has understood why the experiments were undertaken, what conclusions can be drawn from the results, what alternative approaches were considered and why they were rejected, what previous work had been done by others, and what future experiments are being proposed and why. Third, the candidate shall have demonstrated an understanding of the fundamental concepts on which the procedures and ideas were based. Fourth, the candidate shall have demonstrated an understanding of the significance of the research, as well as a breadth of factual knowledge of related areas when the research is viewed in a larger setting. Judgment of his/her success in these matters shall be based on the substance of his/her defense; however, the examination committee shall also expect effective communication, both oral and written.

At the conclusion of this examination, the student will be excused from the room while a decision is reached. The Chairperson of the Committee will inform the student and the research mentor as soon as possible of the decision and the reason(s) for it.

E. Outcomes of the Comprehensive Examination:

Pass: A "Pass" decision is usually arrived at by a unanimous vote by the Comprehensive Examination Committee and admits the student for candidacy to the doctoral program. If a unanimous decision cannot be reached, one dissenting vote is allowed for either a "pass" or "fail" decision. The examining committee has the freedom to recommend or require rewriting of the progress report and research proposal, execution of certain laboratory procedures, or other alternatives which the examining committee may regard as uniquely appropriate to the candidate. This would be considered "Pass with Conditions."

Delay: In the case that the Comprehensive Examination Committee identifies a correctable deficiency in the Comprehensive Examination, the committee will specify remediation, in writing, with a time limit for satisfactory completion. If the deadline is not met by the student, he/she will be recommended for dismissal from the doctoral program. The two outcomes of a Delay are Pass or Fail. The Comprehensive Examination, including any remediation, must be passed within seven semesters from the beginning of the graduate program, unless an extension is granted by the Program Director.

Fail: A “Fail” decision is obtained by unanimous vote of the Comprehensive Examination Committee. As stated earlier, if a unanimous decision cannot be reached, one dissenting vote is allowed for either a “pass” or “fail” decision. If a “fail” decision is reached, no remediation is given and the student will be recommended for dismissal from the doctoral program.

At the discretion of the examining committee, a discussion may be held with the research mentor at the conclusion of the exam. The form to report the examination result is available from the Graduate Programs Secretary (see appendix section 14.5). Within one week of the examination date, the completed form must be returned by the Comprehensive Examination Committee Chairperson to the Graduate Programs Secretary for the recording of the result, filing, and distribution of copies to the student, the research mentor, the Associate Programs Director, the CMB Program Director, the Dean, and each member of the examining committee. A copy of the student's Comprehensive Examination Research Proposal must be maintained by the Program in the student's file for a minimum of three years.

8. THESIS/DISSERTATION DEFENSE AND FINAL ORAL EXAMINATION

8.1 Dissertation

Ph.D. and Plan A M.S. students are required to submit a written dissertation description on their research. Six months prior to the expected completion date, each candidate must meet with his/her Guidance Committee to finalize plans for graduation. Items to be accomplished at this meeting are:

- (a) Evaluation of current status of research and/or course work and identification of areas to be completed or strengthened
- (b) Identification of a realistic timetable for completion. The timetable must include sufficient time between evaluation of the student's final draft of the thesis and his/her planned departure to allow for adequate completion of changes and corrections specified by the Guidance Committee.

The dissertation must conform to the guidelines and requirements of the Graduate School, as published in the *University Guide to the Preparation of Doctoral Dissertations*.

The dissertation may be written in classical form, but the CMB Program encourages a modified form that includes a publishable manuscript (see relevant pages of the above guide). In this modified form, the manuscript(s) or reprint(s) is (are) directly incorporated into the dissertation, together with suitably integrated supplementary parts. These parts usually consist of a more thorough review of the literature and addenda with more detailed methods, results or discussion than can be managed in a publication. If the thesis embraces more material than one published manuscript, a general introduction may be needed. Secondary sections may be included in the more classical thesis form. In recognition of the cooperative nature of modern research, material that involves more than two authors (the student and research mentor(s)) may be included in the body of the thesis or, preferably, as an Appendix. In such cases, a brief explanation of what portion of the work described has been done by the student should be included. All dissertations that have been accepted by the CMB Program are housed in the program office and are available for review.

No later than six weeks before the end of his/her last semester (see calendar in *Schedule of Courses and Academic Handbook*), the student should have the research mentor edit the draft of the thesis before its submission to each member

of the Guidance Committee. The committee members must have two weeks to edit and review the thesis before the final oral examination. After the student has presented a seminar and passed an oral examination in its defense, the student should incorporate into the thesis any recommended changes and corrections before having it produced in final form and permanently bound. The bound copy will contain a page which must be signed by each member of the Guidance Committee. One copy of the abstract must be bound with the dissertation. Not later than two weeks before Commencement, the student must submit to the Graduate Office a final unbound copy of the dissertation and two copies of the abstract. Suitably bound copies are required for the CMB Program, the major professor, and the candidate. The Program and the major professor must each receive a suitable bound copy of the Ph.D. dissertation or M.S. thesis before the Program will certify to the Graduate School that the degree requirements have been fulfilled by the candidate. All doctoral theses submitted to the Office of the Graduate School are to be microfilmed. One microfilm copy will be deposited in the University Library, and it will be available for interlibrary loan. The abstract will be published in *Dissertation Abstracts* and the availability of the dissertation in film form will be announced in *Dissertation Abstracts*. The microfilm fee, required of all doctoral students submitting theses, will cover the cost of the microfilm copy which will be deposited in the library, and the publication and distribution of the abstract.

An extra fee is charged if the dissertation is to be copyrighted. Information about this fee and method of payment may be obtained from the Graduate Office. Microfilming is considered by the University to be a form of publication. Publication by microfilm, however, does not preclude the printing of the dissertation in whole or in part in a journal or monograph.

Plan B M.S. students are required to submit a written report to their Guidance Committee at least two weeks prior to their final oral examination. The format of this written report will be decided by the Guidance Committee.

8.2 Final Examination

The candidate must be registered during the semester in which the final examination is taken. For Ph.D. and Plan A M.S. students, an announcement will be posted one week prior to the final examination and distributed to all faculty. As part of the examination, the student will present an open seminar describing their thesis research. Immediately after the public presentation and discussion, the oral examination on the thesis will be chaired by the research mentor and conducted by the Guidance Committee. Satisfactory completion of the examination requires a unanimous decision of the examining committee. Possible outcomes of the final examination are pass or fail. Ph.D. students should have the "Record of Completion of Requirements for the Doctoral Degree" form (see appendix 14.5) signed by the Guidance Committee, and distributed as directed. The student's folder and a P (or N) grade for CMB999 should be turned into the CMB office. The grade is reported on the Degree Certification form.

At the end of the oral examination, M.S. student's committee should complete the M.S. Final Examination Form (see appendix 14.5), and assign a grade for CMB 899 if appropriate. This form and grade must be submitted to the CMB Program Office. No public seminar is required of Plan B M.S. students. The format of the written final exam for these students will be established by the Guidance Committee.

9. ACADEMIC PERFORMANCE

Students are required to sustain a minimum grade point average of 3.0 in required courses, excluding thesis and collateral work. Any grade below 3.0 in required courses will require remediation, and may prompt review of the student by his/her Guidance Committee, the Associate Programs Director, and the CMB Program Director.

Students must receive a grade of 3.0 or better, or a P in a P-N course, for courses required by the CMB Program or by the student's Guidance Committee. In the event of earning a grade below 3.0, a student may consult with the instructor(s) to agree on a plan to remediate the substandard performance. This plan must be approved by the Director or the Associate Programs Director. Remediation usually requires the student to repeat the course, which requires an override from the Dean's office if the grade is not below a 2.0. Satisfactory remediation of unsatisfactory performance is to be documented in writing by the professor(s) with whom it was negotiated, or by a grade of at least 3.0 upon repeating the course. Failure to obtain a satisfactory grade on remediation, or receiving unsatisfactory grades in more than two required

courses, may result in the CMB Program Director's decision, in consultation with the Associate Programs Director and the Guidance Committee, to dismiss the student from the program. College level policies relative to academic standards can be found in the Academic Programs Book/College of Natural Science Graduate Study section.

Foreign students must demonstrate fluency in oral and written English as certified by the University's English Language Center, and as demonstrated by satisfactory performance in courses, seminars and scientific writing. Since participation in the teaching program is normally done in the second or third years, certification that a foreign student has demonstrated the ability to communicate effectively in English is a requirement before the teaching duties are assigned. Failure to achieve certification (*i.e.* by passing the SPEAK test or equivalent) by the end of the second year will normally result in dismissal from the graduate program.

9.1 Academic Progress, Probation and Dismissal

The CMB Program accepts only those students who are believed to have the potential to successfully complete their degree program. If a student encounters difficulties in meeting the requirements of the program, his/her research mentor (if one has been chosen), the Director/Associate Programs Director, and the Guidance Committee will work together with the student to overcome these problems. As noted elsewhere in this **Manual**, there are isolated instances in which the Director or Guidance Committee may conclude that it is in the best interest of the student (and/or the Program) for her/him to be dismissed from the program, and may so recommend. Such dismissal requires approval of the Director and the Dean. In cases of dismissal, or in instances in which a student chooses to terminate her/his graduate education in the Program or fails to meet the minimum academic standards of the Program, College or University, the Director/Associate Programs Director and/or research mentor will work with the student to identify and take advantage of alternative career opportunities. (See Graduate Students Rights and Responsibilities article 2.4.9.)

10. INTEGRITY AND SAFETY IN RESEARCH AND CREATIVE ACTIVITIES

10.1 Ethical Standards

The unique relationship shared by the public and academic institutions is founded on the integrity of administrators, faculty, students and staff. Graduate students are expected to adhere to the ethical standards set forth in University regulations and those conventionally used in the conduct of scientific research. The Program endorses and adheres to MSU's Rights and Responsibilities of Graduate Students and Regulations as defined in *Spartan Life* (parts II and III, respectively). The monograph published by the Committee on the Conduct of Science (*On Being a Scientist*, National Academy Press, 1994) and Harvard Medical School's *Guidelines for Investigators in Scientific Research* (appendix # 14.4) offer excellent discourses on crucial matters affecting scientific integrity and conflict resolution and are practices/guidelines generally accepted by our faculty.

In the uncommon situation in which a student is charged with violating the standards described above, the student's Guidance Committee will judge the validity of the charge and, if necessary, recommend to the Director an appropriate course of action. If the student in question does not have a Guidance Committee, the CMB Executive Committee will act in its place. In extreme cases, the Director may recommend dismissal. As indicated in Section 12 of this Manual (Judicial Structure), the student may appeal the Director's decision to the Executive Committee. Further appeals would be considered by the College of Natural Science Graduate Hearing Board as defined in article 5 in the Graduate Students Rights and Responsibilities document.

10.2 Safety in Research

The Office of Radiation, Chemical & Biological Safety (ORCBS) establishes and maintains training programs for all involved in the safe and effective handling and storing of hazardous substances, procedures for dealing with accidents; in the proper use of safety equipment; in packaging and disposing of hazardous wastes and in compliance with right to know regulation for unit supervisors in their obligations to inform employees of the risks when working with hazardous materials. All incoming CMB Program students must attend ORCBS training during orientation, or before beginning work in a research lab (whichever comes first).

10.3 Use of Human Subjects in Research

Extensive University, state and federal regulations have been put in place to protect the rights, welfare and privacy of human subjects who participate in research conducted by students and/or faculty affiliated with MSU. To achieve this goal, the Institutional Review Boards (IRBs) will 1) require all investigators be educated in the use of human subjects, 2) review all proposed research involving human subjects prior to initiation of the research, 3) approve, modify or disapprove research according to established criteria for protection of human subjects, and 4) monitor approved research to ascertain that human subjects are indeed protected during the performance of the research. The processes of education, review and monitoring serve to ensure the safe and ethical conduct of research that will protect human subjects in an atmosphere of mutual trust and integrity in the pursuit of knowledge and human benefit.

Graduate students must be aware of these regulations and must comply with them fully in the conduct of their research. These regulations and the processes for adhering to them are administered at MSU by the University Committee on Research Involving Human Subjects (UCRIHS) and are stipulated in detail at the relevant University website (<http://www.humanresearch.msu.edu/overview/mission.htm>).

10.4 Use of Animals in Research

Research utilizing animals at MSU is governed by The *Animal Use & Care Program*, developed to ensure the highest standard of care for research animals and strict adherence to federal and state regulations. Any research involving the use of animals must be approved in advance by the All-University Committee on Animal Use & Care (AUCAUC). Graduate students must be aware of these regulations and must comply with them fully in the conduct of their research. These regulations and the processes for adhering to them are stipulated in detail at the AUCAUC web site: <http://www.aucauc.msu.edu/>

11. WORK RELATED POLICIES

11.1 Desk, Mailboxes and Keys (First Year Students)

Keys will be assigned during rotations. A desk will be provided by the laboratory in which rotations are performed. Mailboxes are located in 2209 Biomedical Physical Sciences Building. The student's residential telephone number and address should be kept current with the Graduate Secretary.

11.2 Student Files

All CMB Program graduate students have a departmental file that is located in the program office. The file contains the students application to the program, ID numbers, evaluations, certificates, results of all committee meetings, comprehensive examinations, and dissertations. The student (with the exception of the confidential letters of recommendation) and CMB faculty members have access to the departmental file. Requests to access the file must come to the Program secretary. In the event that a student wishes to challenge the accuracy of material in the file, he/she may write a letter explaining his/her objections, and this letter will be added to the file.

11.3 Financial Assistance

Graduate research assistantships or fellowships are provided for all incoming Ph.D. students for the first two semesters of study. Thereafter, graduate research assistantships are generally provided from research or training grants or other sources available to the student's research mentor. The CMB Program makes every effort to provide continuing financial support for all Ph.D. students making good progress towards their degree for a minimum of five years in the Program. Assistantships may be provided to M.S. students at the discretion of the Mentor. Stipends are considered as subsidy for education, not payment for employment. All students are encouraged to apply for any available fellowships or other financial aid, internal or external to MSU.

Individuals who are regularly employed as a means of earning a livelihood are not encouraged to undertake a program concurrently. Employed persons admitted to a graduate program normally plan a leave of absence to devote full-time to

research. Other than the required teaching obligations for the doctoral program, any outside work-for-pay must be mutually agreeable to both the mentor and the student. The mentor may agree to allow the student to perform work-for-pay with or without a reduction in grant support or the mentor may not agree to this arrangement. Several departments have some teaching assignments which are less than full-time and solicit for volunteers on an hourly pay basis. Before volunteering for these assignments, a student must have the consent of the mentor.

Students receiving research assistantships should be able to deduct some school-related expenses for federal tax purposes. Due to the tuition waiver, students receiving assistantships, fellowships, and additional scholarships should consult with current federal tax guidelines for descriptions of deductible expenses.

11.4 Appointment and Reappointment to Assistantships and Fellowships

Appointments at the Ph.D. level are normally made for the academic year beginning in Fall semester, program assistantship support will not be extended beyond two semesters, except under unusual circumstances. A student may be awarded a grant-supported assistantship at any time the student is enrolled in the Program, subject to the availability of his/her advisor's extramural funds. Stipend levels are issued annually, at assistantship levels one through three.

11.5 Check Disbursement

The stipend checks are typically disbursed on the fifteenth of each month (unless the 15th falls on a weekend, and then they arrive the Friday before) and are put in mailboxes at that time or the stipend can be directly deposited into a student's account.

11.6 Travel

Financial support for travel of graduate students will be considered in categories of internal and external support. External CMB support is from grants and contracts and will be at the discretion of the principal investigator. Internal support will be from CMB Program funds, and requires approval of the Director. Graduate students are also encouraged to present papers at branch and local meetings, without financial subsidy.

Travel to national meetings will be appropriate mainly for doctoral students in their last year or two of work. Students who are **scheduled to present research papers** at national meetings will be considered for funding. A flat rate will be provided by the Program for graduate students subject to availability of funds. The University requires -- and prudence dictates -- that an economical means of travel and per diem accommodations be utilized. University "per diem" rates are available from the Program office. Any student traveling on University business must have a travel authorization form completed prior to leaving (see appendix 14.5)

11.7 Vacation

Graduate assistants appointed for 12 months are expected to be on campus and actively pursuing graduate education for at least 11 months. Breaks between semesters, if taken, are considered part of the annual one month vacation. Vacations must be arranged with research mentor or in the first year with the professor in whose laboratory the student is rotating.

11.8 Illness/injury/pregnancy leave

A graduate assistant unable to fulfill the duties of the appointment because of illness, injury, or pregnancy shall notify the Director or GPD as soon as circumstances permit. During the illness, injury, or pregnancy the Program will adjust (reduce, waive, or reschedule) the graduate assistant's duties as those duties and the assistant's circumstances reasonably dictate. If total absence from duties becomes necessary, the stipend will be maintained, provided the graduate assistant is still enrolled, for a period of two months, or to the end of the appointment period, whichever should occur first.

The graduate assistant shall have the right to return to the assistantship, within the original semesters of the appointment, at such time as he/she is able to reassume the duties of the position.

11.9 Graduate Student Benefits/Professional Development

Students appointed as Graduate Assistants are provided benefits including health care. Further information can be found in the appendix section 14.3.

Various opportunities for professional development and career services are available to students through the Graduate School, the College, and Career Services. Further information on these Programs can be obtained in the appendix University Resources section 14.3.

12. JUDICIAL STRUCTURE

The Executive Committee will serve to hear student complaints at such times as this becomes necessary. This committee will hear student complaints only if the problem cannot be resolved after consulting with the Director, Associate Programs Director or the student's research mentor. If satisfactory resolution of a conflict is not achieved, the student may seek resolution through the College of Natural Science Graduate Hearing Board as defined in the *Graduate Student Rights & Responsibilities* document.

13. AMENDING AND REVISING THIS MANUAL

Any faculty member or graduate student may submit proposals to amend or revise the *Cell and Molecular Biology Manual for Graduate Study*. Amendments to be considered must be written and circulated to the faculty and graduate students not less than 14 days prior to the meeting at which they are to be voted upon. Amendments must be passed by a majority of the "voting faculty" which is defined in the CMB Program bylaws.

14. APPENDIX

- 14.1 Course Requirements
- 14.2 Typical Timeline for Ph.D. Graduate Studies
- 14.3 University Resources
- 14.4 Guidelines for Investigators in Scientific Research (reprinted from Harvard Medical School)
- 14.5 Administrative Forms
 - A. Laboratory Rotation Report
 - B. Report of the Guidance Committee
 - C. Preliminary Examination Report
 - D. Record of Comprehensive Examinations
 - E. Yearly Guidance Committee Report
 - F. Mentor's Annual Evaluation of Ph.D. Candidate's Progress Report
 - G. Record of Dissertation and Oral Examination Requirements for Doctoral Degree Candidate
 - H. M.S. Final Examination Form
 - I. Travel Voucher

14.1 Course Requirements

The following 3 courses are required.

BMB 801 - Molecular Biology

BMB/MMG/PSL 825: Cell Biology

Either MMG 833 (Microbial Genetics) or MMG 835 (Eucaryotic Molecular Genetics)

A minimum of 2 elective lecture courses, chosen from the following list (or alternatives approved by the CMB Executive Committee).

BMB 803 - Protein Structure and Function (2 credits, fall)

BMB 802 - Metabolic Regulation / Signal Transduction (3 credits, spring)

BMB 804 - Biochemical Mechanisms and Structure (3 credits, spring)

PLB/BMB 856 - Plant Molecular Biology (3 credits)

BMB 864 - Plant Biochemistry (3 credits)

PLB 865 - Plant Growth and Development (3 credits, fall)

MMG 851 - Immunology (3 credits)

MMG 861 - Advanced Microbial Pathogenesis (3 credits, fall)

PSL 828 - Cellular and Integrative Physiology (4 credits, spring)

BOT 880 - Plant Virology (4 cr)

BOT 881 - Molecular and Biochemical Plant Pathology (3 cr)

ENT 851 - Molecular Entomology (3 cr)

PHM/PSL 827 -Physiology and Pharmacology of Excitable Cells (4 cr)

MMG 821 - Microbial Physiology (3 credits)

CMB 892 (Research Forum)

2 semesters as a registered participant (fall of years 1 and 2, 1 credit each)

2 semesters as a presenter (years 3-5)

A total of 3-4 seminar courses, chosen from the following:

CMB 800 or BMB 961 (Computer Analysis of Nucleic Acids and Proteins)

1 course in scientific ethics, such as NSC 830 (Nature and Practice of Science) or its equivalent as approved by the CMB Executive Committee.

14.2 Typical Timeline for Ph.D. Graduate Studies

<i>Year 1</i>	<i>Fall Semester</i>	<i>Spring Semester</i>
	Entry into program	New classes begin (e.g., BMB/MMG/PSL 825, MMG 835, BMB 802)
	Advisement by Director	Begin third laboratory rotation
	Begin classes (e.g., BMB 801, MMG 833, BMB 803, PLB 865, CMB 892)	Select major professor by end of term and begin thesis research project
	Initiate first 10-week laboratory rotation	
	Begin second 10-week laboratory rotation	
<i>Year 2</i>	Appropriate courses selected with mentor	Additional courses as needed
	Continue research/seminar classes	Continue research/seminar classes
	Identify Guidance Committee members	Comprehensive examination during this semester or summer
	First Guidance Committee meeting	Possible teaching assignment
	Enroll in CMB 892	
	Possible teaching assignment	
<i>Year 3</i>	Additional courses as needed	Additional courses as needed
	Continue research/seminar classes	Continue research/seminar classes
	Annual Guidance Committee Meeting	
	Present in CMB 892	
<i>Year 4</i>	Fall semester and beyond	
	Additional courses as needed	
	Continue research	
	Annual Guidance Committee meeting	
	Present in CMB 892	
<i>Year 5</i>	Write Dissertation	
	Final Examination	

14.3 University Resources

Academic Programs

Lists programs, policies, rules, regulations, procedures, fees, tuition, housing rates, organizational structure of the University.

www.reg.msu.edu/ucc/ucc.asp

Address Changes

Changing your address with the University will ensure that your tuition bill or other items will reach you. You can do this on StuInfo.

www.ntweb1.ais.msu.edu/StuInfo/

Career Services and Placement

www.csp.msu.edu

Cell and Molecular Biology Program, Michigan State University

www.ns.msu.edu/cmb/

College of Natural Science, Michigan State University

www.ns.msu.edu/

Council of Graduate Students

www.msu.edu/~cogs/

Description of Courses

Can be found by going to the Registrar's Office web page

www.Reg.msu.edu or ntweb1.ais.msu.edu/j4100/scripts/catalogsearch.asp

Graduate Assistant Health Insurance Plan

www.hr.msu.edu/HRsite/Benefits/Students/HealthCov/

Graduate School, Michigan State University

www.grad.msu.edu/

Graduate Student Resource Guide

www.vps.msu.edu/SpLife/default.pdf

Graduate Student Rights and Responsibilities

www.vps.msu.edu/SpLife/default.pdf

Guidelines for Graduate Student Advising and Mentoring Relationships

grad.msu.edu/staff/mentoreport.pdf

Guidelines for Integrity in Research and Creative Activities

grad.msu.edu/staff/mentoreport.pdf

MSU/GEU Contract

grad.msu.edu/geu/agree.pdf

MSU Parking Permit

You may register for your MSU parking permit on-line.

www.dpps.msu.edu/

MSU Wired

A guide to MSU's On-line Services.

www.msuwired.msu.edu/

Office of Radiation, Chemical & Biological Safety

www.orcbs.msu.edu

Office of the Ombudsman

Information about policy relative to the AFR and GSRR can be found on Stan Soffin's web site

www.msu.edu/unit/ombud/

On Being a Scientist

Responsible Conduct in Research

www.nap.edu/books/0309051967/html/index.html

StuInfo

Provides students, student guests, and authorized faculty or administrative staff access to student and enrollment information. Student specific information includes: Schedule/enrollment, Grades, Academic, Student account, Holds, Address, and Financial Assistance data. Direct deposit and other payroll forms such as the W-4 withholding form can be submitted on-line as well.

www.ntweb1.ais.msu.edu/StuInfo/

14.4 Guidelines for Investigators in Scientific Research (reprinted from Harvard Medical School)

I. Introduction

These guidelines describe practices generally accepted by members of the Faculty of Medicine and already in effect in their laboratories. The primary intent of codifying them is to bring them to the attention of those beginning their careers in scientific research. These recommendations are not intended as rules, but rather as guidelines from which each group of investigators can formulate its own set of specific procedures to ensure the quality and integrity of its research.

II. Supervision of Research Trainees:

Careful supervision of new investigators by their preceptors is in the best interest of the institution, the preceptor, the trainee, and the scientific community. The complexity of scientific methods, the necessity for caution in interpreting possibly ambiguous data, and the need for advanced statistical analysis, all require an active role for the preceptor in the guidance of new investigators. This is particularly true in the not uncommon circumstance of a trainee who arrives in a research unit without substantial experience in laboratory science.

Recommendations:

The responsibility for supervision of each junior investigator should be specifically assigned to some faculty member in each research unit.

The ratio of trainees to preceptors should be small enough that close interaction is possible for scientific interchange as well as oversight of the research at all stages.

The preceptor should supervise the design of experiments and the processes of acquiring, recording, examining, interpreting, and storing data. (A preceptor who limits his/her role to the editing of manuscripts does not provide adequate supervision.)

Collegial discussions among all preceptors and trainees constituting a research unit should be held regularly both to contribute to the scientific efforts of the members of the group and to provide informal peer review.

The preceptor should provide each new investigator (whether student, postdoctoral fellow, or junior faculty) with applicable governmental and institutional requirements for conduct of studies involving health volunteers or patients, animals, radioactive or other hazardous substances, and recombinant DNA.

III. Data Gathering, Storage, Retention:

A common denominator in most cases of alleged scientific misconduct has been the absence of a complete set of verifiable data. The retention of accurately recorded and retrievable results is of utmost importance for the progress of scientific inquiry. A scientist must have access to his/her original results in order to respond to questions including, but not limited to, those that may arise without any implication of impropriety. Moreover, errors may be mistaken for misconduct when the primary experimental results are unavailable. In addition, when statistical analysis is required in the interpretation of data, it should be used in the design of studies as well as in the evaluation of results.

Recommendations:

Custody of all original primary laboratory data must be retained by the unit in which they are generated. An investigator may make copies of the primary data for his/her own use.

Original experimental results should be recorded, when possible, in bound books with number pages. An index should be maintained to facilitate access to data.

Machine print-outs should be affixed to or referenced from the laboratory notebook.

Primary data should remain in the laboratory at all times and should be preserved as long as there is any reasonable need to refer to them. The chief of each research unit must decide whether to preserve such primary data for a given number of years or for the life of the unit. In no instance, however, should primary data be destroyed while investigators, colleagues, or readers of published results may raise questions answerable only by reference to such data.

IV. Authorship:

A gradual diffusion of responsibility for multi-authored or collaborative studies has led in recent years to the publication of papers for which no single author was prepared to take full responsibility. Two critical safeguards in the publication of accurate, scientific reports are the active participation of each co-author in verifying that part of a manuscript that falls with his/her specialty area and the designation of one author who is responsible for the validity of the entire manuscript.

Recommendations:

Criteria for authorship of a manuscript should be determined and announced by each department or research unit. The Committee considers the only reasonable criterion to be that the co-author has made a significant intellectual or practical contribution. The concept of "honorary authorship" is deplorable.

The first author should assure the head of each research unit or department chairperson that s/he has reviewed all the primary data on which the report is based and provide a brief description of the role of each co-author. (In multi-institutional collaborations, the senior investigator in each institution should prepare such statements.)

Appended to the final draft of the manuscript should be a signed statement from each co-author indicating that s/he has reviewed and approved the manuscript to the extent possible, given individual expertise.

V. Publication Practices:

The Committee has observed certain practices that make it difficult for reviewer and reader to follow a complete experimental sequence: the rapid publication of data without adequate tests of reproducibility or assessment of significance, the publication of fragments of a study, and the submission of multiple similar abstracts or manuscripts differing only slightly in content. In such circumstances, if any of the work is questioned, it is difficult to determine whether the research was done inaccurately, the methods were described imperfectly, the statistical analyses were flawed, or inappropriate conclusions were drawn. Investigators should review each proposed manuscript with these principles in mind.

Recommendations:

The number of publications to be reviewed at times of faculty appointment or promotion should be limited in order to encourage and reward bibliographies containing fewer but more substantive publications rather than those including many insubstantial or fragmented reports. (It has been suggested, for example, that no more than 5 papers be reviewed for appointment as Assistant Professor(s), no more than 7 for Associate Professor(s), and no more than 10 for Professor(s).)

Simultaneous submission of multiple similar abstracts or manuscripts to journals is improper.

VI. Laboratory Guidelines:

Because each research unit addresses different scientific problems with different methods, each unit should develop its own specific guidelines to identify practices that seem most likely to enhance the quality of research conducted by its members. Those guidelines should be provided to the new investigator upon starting work.

14.5 Administrative Forms

Sample copies of the Michigan State University administrative forms that the CMB Program graduate student will use during his/her graduate study are included for informational purposes. These forms have been mentioned throughout this handbook. Obtain an original form from the CMB Program Office, 2240A Biomedical Physical Sciences Building.

Last updated 6/21/2005

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