

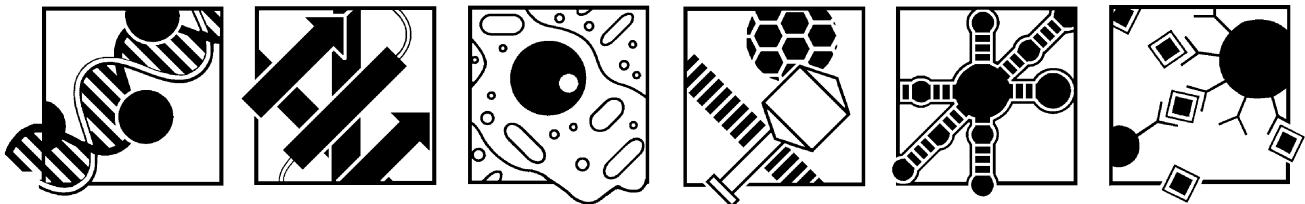
# **GRADUATE PROGRAM IN CELLULAR & MOLECULAR BIOLOGY**

**UNIVERSITY OF MICHIGAN**

*<http://www.med.umich.edu/cmb/>*

## **CMB STUDENT AND FACULTY HANDBOOK**

**2010 Edition**



**GRADUATE PROGRAM IN CELLULAR AND MOLECULAR BIOLOGY**

**STUDENT AND FACULTY HANDBOOK**

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**GRADUATE PROGRAM IN CELLULAR AND MOLECULAR BIOLOGY**

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**GRADUATE PROGRAM IN CELLULAR AND MOLECULAR BIOLOGY  
CMB PROGRAM COMMITTEE  
2010-2011**

**Faculty**

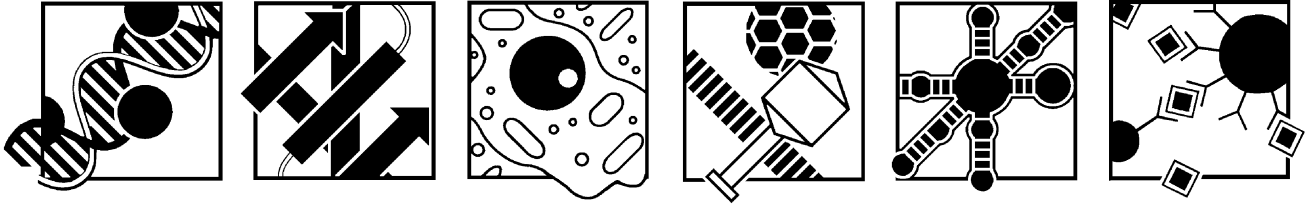
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<b>Ronald Koenig</b>	Internal Medicine, MSTP Director
<b>Jiandie Lin</b>	Cell & Developmental Biology
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<b>John Moran</b>	Human Genetics/Internal Medicine

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<b>Mindy Waite</b>	Donna Martin

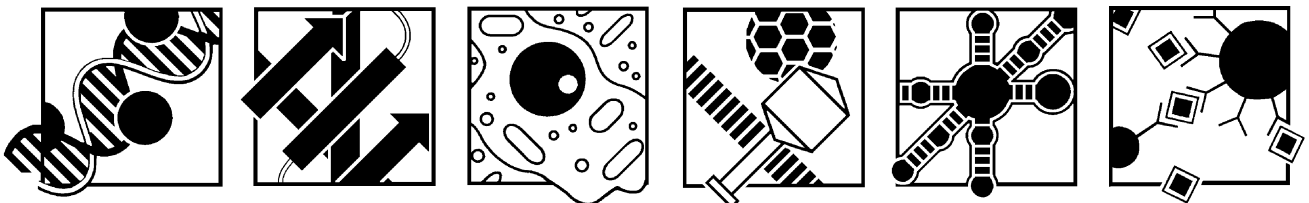
**Ad-Hoc Members**

<b><i>Name</i></b>	<b><i>Department</i></b>	<b><i>Role in Program</i></b>
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<b>Christin Carter-Su</b>	<b>Molecular &amp; Integrative Physiology</b>	<b>CMB 850 Director</b>
<b>Richard Miller</b>	<b>Pathology</b>	<b>Preliminary Exam Chair</b>
<b>Philip Gage</b>	<b>Ophthalmology &amp; Visual Sciences</b>	<b>Admission Committee Chair</b>



# **CMB STUDENT AND Faculty HANDBOOK**

**2010 Edition**



# CELLULAR & MOLECULAR BIOLOGY PROGRAM

## STUDENT AND FACULTY HANDBOOK

### STUDENTS

#### GENERAL INFORMATION AND TIMETABLE

The Graduate Program in Cellular and Molecular Biology (CMB) at the University of Michigan is a University-wide, interdisciplinary Ph.D.-granting Program. It provides broad-based training in research involving cellular and molecular biology. CMB trains students to address biological problems from multiple perspectives through individualized, flexible programs of coursework and research.

This guide outlines the steps necessary for students to complete the requirements for the Ph.D. degree in the CMB Program. A provisional timetable for completion of the program is provided, although each student is guided through the program individually. Students can select CMB after the first year in the Program in Biomedical Sciences (PIBS) or after the second year in the Medical Scientist Training Program (MSTP). The timetable is organized according to candidacy status for the Ph.D. degree.

Milestone	To be completed by	
<b>Pre-Candidate</b>	<b>PIBS</b>	<b>MSTP</b>
	<b><u>First Year</u></b>	
Lab Rotations (at least 2; additional possible)	End of 1st yr (within PIBS)	End of M2 yr
Course work	End of 2nd yr	End of 1st grad yr
Responsibility in Research	End of 1st yr (within PIBS)	End of 1 <sup>st</sup> grad yr
Selection of thesis advisor	End of 1st yr	End of 1 <sup>st</sup> grad yr
	<b><u>Second Year</u></b>	
Course work (15 credits minimum)	End of 2nd yr	End of 1st grad yr
Student Seminar (CMB 850)	Attend throughout	Attend throughout
Presentation of first seminar for CMB 850	End of 2nd yr	End of 1st grad yr
Short Courses (CMB 630)	Attend at least 4 semesters	Attend at least 4 semesters
Preliminary exam	2 <sup>nd</sup> year per timeline	1st grad yr
Advance to Candidacy	End of 2nd year	End of 1st grad yr
Assemble Thesis Committee	End of 2nd year	End of 2nd grad yr
<b>Candidate</b>	<b><u>Third Year and Beyond</u></b>	
Thesis Committee Meetings	Every 6 months	Every 6 months
Student Seminar (CMB 850)	Attend throughout	Attend throughout
Short Courses (CMB 630)	Attend at least 4 semesters	Attend at least 4 semesters
Teaching (one term)	End of 4th yr	End of 4th grad yr
Completion of Degree Requirements	5 yrs expected	5 yrs expected

Please feel free to discuss any aspect of this guide with members of the CMB Program Committee at any time. A major asset of the CMB program is its flexibility. The Program Committee considers petitions to alter requirements of the training program outlined here to meet the needs of individual students.

## **ACADEMIC ADVISING**

PIBS students meet with the CMB Faculty Advisor or CMB Director as needed for information about CMB and coursework during the first year. A senior CMB student volunteer is also available as a Precandidate Advisor, to discuss course selection and scheduling from a student perspective.

Each pre-candidate CMB student meets individually with the CMB Director twice a year, before Fall and Winter terms, to discuss course work, lab rotations, student seminars, prelim preparations and performance. These meetings facilitate smooth and efficient transitions from the first PIBS year into the CMB Program. The flexibility and individualized nature of CMB training allows optimal overlap with typical course selections during the first year.

CMB students who have achieved candidacy meet individually with the CMB Director at least once each year. At the end of each term, the CMB Director reviews each student's transcript, lab progress and thesis research report, and thesis committee meeting reports.

**Curriculum Advising Format.** An advisory panel of CMB faculty from various departments who are knowledgeable about relevant courses meet with pre-candidate students prior to course registration each term. In parallel, a panel of senior CMB students is available for consultation on course selections. Students may also request individual meetings with Curriculum Advisors and/or the Program Directors.

## **COURSE SELECTION**

### **Objectives for the CMB curriculum**

- 1) Provide flexibility and efficiency for integrating coursework and dissertation research.
- 2) Maximize curriculum possibilities for each student by customizing coursework that builds on pre-graduate education.
- 3) Facilitate transition from PIBS into CMB.

### **Areas to be covered in coursework**

**1. Basic coursework:** CMB students are required to take 3 credits of coursework in each of 3 areas (9 credits total): a. Biochemistry; b. Cell Biology; c. Genetics.

The specific courses elected to fulfill these requirements should be based on student's prior educational background. See discussion of proficiency levels on p. 8 and basic coursework options described below.

**2. Elective coursework:** CMB students take 6 additional elective credits. It is recommended that the electives be selected to complement the student's research interests and needs. Courses that include quantitative training (see p. 9) are strongly encouraged. Course offerings change frequently, so ***students should check the PIBS Curriculum Guide for the most recent listings: <http://www.med.umich.edu/pibs/pdf/curriculum.pdf>***

The Rackham Graduate School requires students to complete a minimum of 18 credits of graded coursework while at the Ann Arbor Campus to achieve candidacy. Students register for at least 9 credits each semester as precandidates.

**3. CMB courses and research responsibility:** Precandidate students should elect the following:

**a. CMB Student Seminar (CMB 850) (1 credit)** – *Mandatory weekly attendance throughout Ph.D. training, starting in the second year. Register each Fall and Winter term.*

Precandidates present a critical review of a report in the scientific literature; senior students present their own research. Students and faculty participate in the seminar discussion and periodically serve as seminar evaluators. Training in presentation skills is built into preparation and presentation of seminars. See “The CMB Student Seminar (CMB 850)” p. 10.

**b. CMB Short Course (CMB 630) (1 credit)** – *Advanced Topics in Molecular Biology. Offered Fall and Winter terms. Students attend at least four different terms.*

Each of these “Short Courses” is a mini-symposium consisting of a series of seminars and discussions on a special topic of current interest to students, presented by leaders in the field invited over several weeks each semester. The courses are designed to facilitate student interactions with visiting speakers. (Sponsored cooperatively by the CMB Program and the Genetics Pre-doctoral Training Program). See p. 12 for details.

**c. Research Responsibility (PIBS 503) (1 credit)** – *Offered each year.*

Training in Research Responsibility is required of every CMB student. See p.12 for details (Training in Ethical Issues in Science,).

**Individualizing Coursework Selections** (*sample curricula – see Appendix B*):

The overall goal of coursework is to give CMB students familiarity with each basic area at a level of competence to understand and interpret the current scientific literature. An additional goal of coursework for CMB students is to gain experience reading and interpreting primary literature, typically in a more discussion-oriented setting than traditional lecture-based courses. Students with a degree and/or substantial prior classwork in one of the basic coursework areas (e.g., Bachelor’s in Biochemistry, or Genetics) are encouraged to take primary literature-based courses.

**Levels of Proficiency:**

The following levels of proficiency generally describe the prior background students may have in a particular area to guide them in course selection, and allow flexibility for students to tailor a curriculum specific to their own backgrounds.

**Level 1.** No background/coursework in the basic area. An introductory class is recommended; in some cases, this may be an upper level undergraduate course (400-500 level).

**Level 2.** Some background in the basic coursework area, but not sufficient for Ph.D. training. A mid-level survey course is recommended (500 level – corresponding to current PIBS “core” courses).

**Level 3.** Graduate-level background has already been achieved by the student, such as graduate level courses or a bachelor’s degree in the area. Courses based on primary literature are recommended.

It is important that students discuss their previous coursework with the curriculum advisers and/or the Director to determine the appropriate level for each basic area. It will be helpful for students to provide recent transcripts and syllabi or descriptions of previous courses when requesting a more advanced level (3). Students should give considerable thought regarding their level of familiarity in each area to ensure that they are sufficiently knowledgeable if proposing to move up a level. Additionally, students should discuss with the mentor whether they should strengthen background in areas critical for their success in their chosen laboratory.

**Basic coursework options:**

Courses listed are recommendations; a student may request permission for other classes. Note that course offerings change frequently. **Students should check the PIBS Curriculum Guide for the most recent listings:** <http://www.med.umich.edu/pibs/pdf/curriculum.pdf>

**Biochemistry (3 credits)**

- Level 1.** BIOLCHEM 515-Introductory Biochemistry (3 cr)
- Level 2.** BIOLCHEM 550-Macromolecular Structure and Function (3 cr)  
CHEMBIO 501/502-Chemical Biology I/II (3 cr/3 cr)
- Level 3.** BIOLCHEM/PHYSIOL/PHRMACOL 576-Signal Transduction (1 cr)  
BIOLCHEM/PHYSIOL/PHRMACOL 591-Special Topics in Signal Transduction (2 cr)  
BIOLCHEM 640-Post-transcriptional mechanisms (2 cr)  
BIOLCHEM/CDB/MICROBIOL 675 -Advanced Topics in Protein Trafficking and Localization (2 cr)  
BIOLCHEM 673- Kinetics & Ligand Binding (2 cr)

**Cell Biology (3 credits)**

- Level 1.** MCDB 428-Cell Biology (4 cr)
- Level 2.** CDB 530-Cell Biology (3 cr)  
PHYSIOL 576/577-Signal Transduction/Membrane and Cellular Physiology (1 cr/2 cr)
- Level 3.** CDB 680- Organogenesis of Complex Tissues (3 cr)  
MICROBIOL 640-642- Molecular and Cellular Immunology I/II/III (3 cr/1 cr/1 cr)  
MICROBIOL 553-Cancer Biology (3 cr)  
CDB 550-Histology (4 cr)

**Genetics (3 credits)**

- Level 1.** MCDB 427-Molecular Genetics (4 cr)
- Level 2.** HUMGEN 541-Molecular Genetics (3 cr)
- Level 3.** BIOLCHEM 650-Mechanisms of Eukaryotic Gene Expression (3 cr)  
CDB 580 - Developmental Biology (3 cr)  
HUMGEN/PHYSIOL 555- Integrative Genomics  
HUMGEN 542-Genetic Basis for Disease (3 cr)

**Quantitative Training**

Descriptions of the available courses containing quantitative training can be found on the PIBS website (<http://www.med.umich.edu/pibs/current/quantitativebio.htm>)

- BIOSTAT 553- Applied Biostatistics (Statistics 400 or BIOSTAT 503 are alternates)
- BIOINF 525 - Foundations of Bioinformatics and Systems Biology. Introduction to statistics and to bioinformatics tools on the web for students interested in using Web-based applications and browsers.
- BIOINF 527- Introduction to Bioinformatics and Computational Biology. For students with basic statistics and some programming knowledge who want to go deeper into bioinformatics.
- EECS 498 or BIOINF 575- Introduction to Programming. Introductory computer programming courses for those interested in getting more involved in analysis.
- PHYSIOL 520- Computational Systems Biology in Physiology. Introduces relevant biochemistry and mathematical modeling before delving into systems biology applications.

**Alternative Courses (up to 3 credits)**

To facilitate the ability of students who did not follow the CMB curriculum at the outset to switch into CMB from other PIBS programs, in some cases the basic coursework may be fulfilled with an introductory survey class(es) from other PIBS programs. This is discussed on a case-by-case basis. Typically, these courses fulfill elective credits.

- BIOINFO 525 or 527-Introduction to Bioinformatics
- BIOPHYS 520- Energetics, Interactions, and Dynamics of Biomacromolecules
- BIOSTAT 503-Introduction to Biostatistics

MCDB 614-Experimental Models in Molecular, Cellular and Developmental Biology  
MICROBIOL 640-642-Molecular and Cellular Immunology  
NEUROSCI 601-Principles of Neuroscience  
PATH 581-Tissue, Cellular and Molecular Basics of Disease  
PHARMACOL 611-Principles of Pharmacology  
PHYSIOL 510- Systems & Integrative Physiology

### **Additional Considerations**

- 1. Curriculum Advising Format.** An advisory panel of CMB faculty from various PIBS programs meets with pre-candidate students prior to course registration each term. In parallel, a panel of senior CMB students will be available for consultation on course selections. Students may also request individual meetings with Curriculum Advisors and/or the Program Director.
- 2. Scientific Writing.** Some courses, particularly in Level 3, incorporate training in scientific writing. Students often find that this helps them to prepare for the preliminary examination and future grant writing.
- 3. Academic Performance.** Students are required to earn a grade B or better in required course work, and maintain an overall average of B or better for coursework.

### **MSTP students in CMB**

MSTP students receive 18 credit hours for medical school coursework. This typically includes training in biochemistry and cell biology that satisfies CMB requirements in these areas. MSTP students are required to take coursework in genetics (e.g. Human Genetics 541), ethics (PIBS 503), and the CMB student seminar course (CMB 850). In addition, MSTP students take a minimum of three additional elective credits in graduate coursework to fulfill CMB requirements. Additional requirements are the same as for other CMB students (participation in at least 4 CMB/Genetics short courses, teaching one semester).

### **THE CMB STUDENT SEMINAR (CMB 850)**

#### **Overview**

The Special Topics Seminars (CMB 850) in Fall and Winter terms consist of student seminars presented 12-1PM every Monday. These seminars bring the Program together each week. All CMB students, including candidates, and CMB faculty, participate in and contribute to the student seminars. Precandidates in the CMB Program are required to register for the course. All candidate students are also required to attend (whether or not they enroll for credit). First year students in PIBS can attend CMB 850 seminars and may request an opportunity to present a seminar. The seminar date for each student is indicated on a schedule prepared by the Student Seminar Coordinators at the beginning of each academic year. To accommodate attendance by all CMB faculty while maintaining the personal nature of student-faculty interactions, each CMB faculty member is assigned at least three attendance dates during the academic year. Two CMB faculty co-directors coordinate 15-20 faculty dedicated to serving as evaluators for the course each year (Student Seminar Committee).

Precandidate students generally present a critical review of one or two related reports in the current scientific literature dealing with a significant advance in molecular/cellular biology. The presentation should be a critical evaluation of the work, not simply a summary of it. Some paper choices are coordinated with the topic of each term's Short Course. Third year students generally serve as evaluators and chair the discussion session that follows the seminar. Senior students present seminars on their own research.

Students work with a faculty advisor, generally the research mentor, to prepare the talk and practice it formally before the actual presentation. In addition, a practice session is scheduled during the week prior to the

scheduled seminar, that is attended by the mentor, a faculty evaluator, a student evaluator and others invited by the student. At the formal seminar, discussion and criticism of the research by the audience is encouraged. The assigned student discussant moderates the discussion, which includes students and faculty. At least one faculty member and a student evaluator discuss the presentation with each student at the end of the session and prepare a brief written evaluation which is shared with the student and sent to the CMB office.

### **Specifics of Seminar Preparation**

1. At the beginning of each fall term, a schedule is set up for student presentations for the academic year. Each student is expected to arrange for a faculty mentor to help prepare for the seminar in the faculty member's field of interest.
2. At least four weeks prior to the presentation, each student should begin preparations with the faculty mentor. They should discuss the topic, identify interesting papers, and the student should begin preparing the presentation with advice from the faculty member. In keeping with the broad approaches in CMB training, it is recommended that students select papers from the highest quality journals of broad interest rather than from specialty journals.
3. One week prior to the seminar, the student should:
  - A. Provide the CMB Administrator with the principal references (including pdf or url), relevant secondary references and a paragraph summarizing the topic. This is distributed to all CMB faculty and students by e-mail prior to the presentation.
  - B. Students should schedule a formal practice with the assigned faculty evaluator as well as the faculty advisor and student evaluators. Evaluators provide comments about the strengths and weaknesses of the presentation. Based on feedback from the practice session, the student has an opportunity to implement suggestions for the formal seminar presentation the following week. Student presenters are encouraged to make arrangements for this practice session with faculty and student evaluators one to two weeks before the practice session. For convenience, the seminar room is generally reserved on Fridays for rehearsals.
4. The student presents the seminar to assembled CMB students, faculty and other interested individuals, and answers questions from the floor. Audiovisual equipment is available or requested via the CMB office. The assigned student discussant/evaluator provides a professional introduction to the speaker, prepares questions to lead off discussion during the seminar and serves as moderator during the discussions. The discussant also provides a final evaluation to the presenting student following the seminar.
5. A faculty member from the Student Seminar Committee and one of the student discussants meet with each student immediately after the presentation to discuss strengths and weaknesses of the seminar. Written critiques from the evaluators are made available to the student.

### **THE CMB Short Course (CMBIOL/HUMGEN 630; Advanced Topics in Molecular Biology)**

The CMB Short Course is designed to introduce students to high profile or 'hot topics' research areas and allows students to interact closely with leading investigators from other institutions. Each Short Course is a mini-symposium composed of four-five presentations on a thematic topic which takes place over several weeks during the academic semester. A volunteer committee of CMB students develops the Short Course topic and invites speakers and hosts speakers during their visit to the university. Students in the CMB Program are required to enroll in the Short Courses for at least four semesters during their graduate studies. Students enrolled in CMB 630 are required to attend all Short Course seminars, to attend any additional scheduled discussion sessions, and/or complete assignments related to the Short Course, as determined by the Short Course coordinators. Generally, enrolled students attend the public seminar, meet with the speaker in a discussion session separate

from the seminar presentation and are asked to submit at least one question for each speaker. Additional sessions interacting with the speaker often include lunch and/or a question and answer session with the speakers on the day of the Short Course seminar.

### **TRAINING IN ETHICAL ISSUES IN SCIENCE**

To ensure that all students have appropriate training in research responsibility they are required to take PIBS 503: Research Responsibility and Ethics. This course consists of a series of small group discussions in which issues related to responsible research and ethics are discussed. The syllabus satisfies NIH mandates, required for trainees supported on F, K and T series awards are required to comply. Rather than formal lectures, the course consists of lectures and panel discussion, which are provided in the form of podcasts. The podcasts as well as case studies and other resources related to the podcasts are provided on a Course Tools website, and an interactive calendar that lists the topic, time, place and date of small group discussions for 12-16 students. The small group discussion are provided by 72 faculty volunteers from all the PIBS programs and by training grant faculty members and are offered throughout the fall term. Students may select times and places for the small group discussions that fit their schedules.

The six discussion topics, with associated case-studies, are:

- 1) Fraud, Fabrication, and Plagiarism
- 2) Data Storage and Ownership and Peer Review
- 3) Animal Use and Care
- 4) Human Subjects Research and IRBs
- 5) Conflict of Interest (Scientific and Financial)

Then participants in the course may choose between the following two subjects:

Research in the Global Workplace (Cultural Issues, International collaboration, Women, Underrepresented Minorities)

OR

Dual Use Issues (which address potential misuse of scientific information as in bioterrorism)

On entering the graduate program through PIBS, students are also issued copies of the Rackham Graduate School "Student Handbook" and the University of Michigan Medical School "Guidelines for Responsible Conduct of Research." The former addresses the standards of student behavior expected of all members of the graduate community. The latter discusses in depth the responsibilities of a Ph.D. mentor, appropriate methods of data collection and analysis, guidelines for manuscript authorship and issues pertaining to relationships between industry and academic institutions. Students will be expected to sign a statement stating that they understand the potential penalties (including dismissal from the graduate school and the possibility that a doctoral degree will not be awarded) for fraud, fabrication and plagiarism in course papers, prelims and dissertations and presentations/websites.

### **LABORATORY ROTATIONS**

During the first year, under the auspices of PIBS, each student participates in research immediately upon entering the University by completing at least two laboratory rotations. Students interested in CMB must complete at least one rotation under the supervision of a CMB Program faculty member. The duration of one laboratory rotation is generally one full term, and can include summer rotations prior to and after the first academic school year. Half-term rotations may be arranged with permission of the mentors. The student receives academic credit for each rotation by enrolling in PIBS 600 or in CMB 599 (Non-Dissertation Research) for a number of hours arranged in consultation with the sponsoring faculty member. At least two laboratory rotations should be completed during the first 10 months of enrollment and must be completed prior to the

selection of a dissertation mentor. Students may choose to do additional rotations before selecting a mentor. The appropriateness of rotations with faculty outside of CMB will be reviewed by the CMB Program Committee.

New students are urged to become acquainted with research interests of the CMB Program Faculty. These are detailed in the CMB Program brochure and on the CMB website ([www.med.umich.edu/cmb/](http://www.med.umich.edu/cmb/)). Faculty new to CMB present their research at “New Faculty” luncheons coordinated by PIBS. A valuable source of information is the Program-wide CMB Poster Session held during the Annual CMB Symposium early each academic year. Students also learn about CMB faculty research in private discussions with faculty members, public seminars and research presentations, and in literature surveys.

**Picking the right rotations** is critical for finding a dissertation lab where the student will be successful. Before choosing a rotation lab, students should meet with the professor to discuss expectations and research projects. Some questions students may want to ask before choosing a rotation lab:

- Is the lab currently taking new students? How many other students are interested in rotating and how many new students can the mentor accept into the lab?
- What does the mentor expect from rotation students? How much time do rotation students generally spend in the lab and how much data are students expected to produce?
- What projects are available? Does the mentor expect the student to complete a project on a grant or do graduate students have more freedom to define their own research projects?
- How many people are in the lab and are the other members of the lab experienced researchers? Do the members of the lab enjoy training students? Are lab members happy in the lab?
- How are lab meetings and meetings with the mentor structured? Is there a venue for supportive and open discussion of student’s work within the lab and with the mentor?
- Does the lab have sufficient funds to support a graduate student through the duration of the dissertation research? Where does the funding come from? Are students expected to apply for training grants or write grant proposals to secure their own funding?
- What is the mentor’s managing style? Younger researchers are more likely to be in the lab and involved in training students on a day-to-day basis, while more senior professors often have administrative and professional duties that keep them away from the lab some of the time.
- How long has it taken previous graduate students to complete their degrees?

### **SELECTION OF A DISSERTATION MENTOR AND THESIS RESEARCH**

Each student selects a dissertation mentor from the CMB Faculty to guide his or her dissertation research. As soon as possible after completion of laboratory rotations, the student should submit his/her choice of mentor to PIBS and to the CMB Director. The selection of the dissertation mentor should generally occur by the end of the first academic year of study.

Once a student selects a lab, CMB research credits are elected each term. The research is conducted in the context of CMB 990 for precandidates, and CMB 995 for Candidates.

The dissertation mentor submits a report of thesis research progress to the CMB office each term throughout the student’s training. This report should first be discussed and signed by both mentor and student. It is then reviewed by the Program Directors. The mentor and student are responsible for coordinating thesis committee meetings every six months, and submitting thesis committee reports within two weeks of each meeting.

**PRELIMINARY EXAMINATION.** The preliminary examination must be passed before a student achieves Candidacy for the Ph.D. degree.

### **1. Purpose**

The Preliminary Examination (Prelim Exam) tests the student's ability to reason analytically and to develop ideas and experimental approaches. The exam gives the student an opportunity to demonstrate creativity, imagination and knowledge of one area of current research. The Prelim is typically completed in the student's second year (first graduate year for MSTP students). The specific timing for completion of the Prelim is announced early in each academic year and a timeline is established. This timeline includes a series of goals/checkpoints determined by the CMB Program. Requests for extensions must be submitted in writing to the CMB Program Director. The entire process should take approximately 8 weeks.

### **2. Choosing a Topic**

The Prelim Project must be related, directly or indirectly, to the mentor's research area. The specific project may be the student's proposed thesis topic, and should represent original ideas of the student. The mentor is not involved in the prelim process once the topic is established. The scope of the project should be appropriate for one individual (e.g. a graduate student) to accomplish in 3-4 years with the goal of publishing at least two first-author papers based on the research. The student submits the topic and hypothesis for the study in the format of a Provisional Specific Aims page to the Prelim Coordinator, and meets with the Prelim Coordinator at least once to discuss the provisional Specific Aims. The Prelim Coordinator provides guidance on whether the topic and provisional Aims are suitable. Students who are unsure as to the suitability of a possible topic are encouraged to discuss this with the Prelim Coordinator well in advance of the final deadline for the provisional Specific Aims, and may wish to seek tentative review of a topic area for suitability prior to investing significant time in researching the area for the written proposal.

The provisional Specific Aims, once they are considered acceptable by the Prelim Coordinator, are then used by the student and Prelim Coordinator to invite CMB faculty members to serve on the Prelim Exam Committee.

### **3. Specific Aims**

The student submits a formal Specific Aims page to the Prelim Committee describing the proposed topic and approaches. This page should include how the project evolves from the previous studies, the hypothesis to be tested, the specific aims to address the hypothesis, the general experimental approach used to test the hypothesis and the significance of the project. This page will serve as the first page of the written proposal, in the form of an NIH grant application, that will serve as the basis of the oral examination. The Prelim Committee evaluates the formal Specific Aims within a week of receipt, and the Prelim Committee Chair then tells the student if the Aims are approved. The final Specific Aims may be the same or very similar to the provisional Specific Aims, or may be changed based on the advice from the Committee Chair and new ideas from the student.

### **4. Preliminary Examination Committee**

#### **A. Members**

The student submits the names of two CMB faculty members who have agreed to serve on the examining committee, as soon as the provisional Specific Aims are considered acceptable by the Prelim Coordinator. The student's thesis advisor does not serve as a member of the Prelim Committee but can advise the student on selection of faculty for the committee. The Prelim Coordinator appoints two additional members and appoints one prelim committee member to serve as committee Chair. It is estimated that composing the committee will be completed within one week after acceptance of the provisional Specific Aims by the Prelim Coordinator.

The student is responsible for seeing that each committee member receives a copy of the provisional Specific Aims page describing the research problem. The committee members will review these Specific Aims to determine ultimate feasibility and acceptability of the outlined project and communicate their assessment within one week to the Prelim Committee Chair. The Preliminary Exam Committee Chair will communicate to the student (YES or NO) within ONE WEEK whether the Specific Aims are approved. If the Specific Aims are deemed not appropriate, the Committee Chair, as spokesperson for the full Committee, will explain the concerns with the proposed project, and the student will revise and resubmit the Specific Aim page to the committee within one week.

### **B. Arranging the Exam Date**

Once the committee is chosen, the Prelim Coordinator will notify the student, who will then be responsible for arranging a day and time within the designated Exam period that all of the committee can attend the oral exam. Setting the date should be accomplished as early in the process as possible. The CMB Administrator helps the student reserve a room and obtain appropriate audiovisual aids for that day and time.

## **5. Written Proposal**

### **A. Format**

The written proposal should contain background information and a brief summary of an original experimental approach to a scientific problem of current interest in cellular and molecular biology. The student should use a format similar to that of an NIH grant application: (a) the one page Specific Aims section, as approved by the Prelim Committee; (b) one-half to one page dedicated to Significance and Innovation, in which the student explains why the project is Significant (i.e. important and likely to move the field forward), and Innovative (i.e. not duplicating previous work, but using new methods or approaches or ideas), and (c) up to 8 pages devoted to Approach. The Approach section should include discussions of the experimental design, rationale for selecting each element of the plan, controls, interpretation of possible results, priority of experiments, and limitations and alternative approaches that could be used to circumvent problems that might be encountered. No preliminary data section is necessary, but if preliminary data are included these must fit within the 8 page limit for the Approach section. Space for reference citations is not included in the 10 page limit.

The student is responsible for independently deciding on the problem and devising logical and convincing experimental approaches. When writing the proposal and preparing for the oral presentation, students can ask peers and faculty for advice on execution of specific techniques or specific interpretation of published work. Faculty are encouraged to suggest reading materials when possible, but should not take an active part in experimental design. Others can help proofread the proposal. When in doubt about appropriate boundaries of advice from others, the student should consult with the Chair of his/her Preliminary Exam Committee. Students preparing for the exam can look over copies of recent student proposals that were considered excellent, which are kept on file by the CMB Administrator.

Two weeks prior to the oral exam, the student submits the complete written proposal to members of the Prelim Committee. The proposal should be ten printed pages or less, not counting reference citations. Consistent with NIH guidelines, font size should be not less than 11 point Arial, with not more than 6 lines of type per inch, and margins not less than 0.5 inches on each side.

This written proposal is primarily to place at the disposal of the committee the raw materials for the upcoming exam. When the proposal is completed it is recommended that the written proposal be hand-delivered to each member of the examining committee. A copy should also be submitted to the CMB office.

### **B. Timeline**

All prelim exams will take place in a limited (2-3 week) time frame during Winter Term, as specified for each academic year. The following general timeline for the academic year serves as an example:

Early Dec	Topic and provisional Specific Aims submitted to Prelim Coordinator
Mid Dec	Initial meeting with Prelim Coordinator
Mid-Dec	Names of 2 Prelim Committee members submitted to Prelim Coordinator
Mid Jan	Prelim Committee finalized – student delivers Specific Aims and sets exam date
Late Jan	Prelim Committee approves Specific Aims within one week of receipt
Mid Feb	Written proposal submitted to Prelim Committee
Mid Feb. to March	Prelim Exam Period- all prelims scheduled during this interval.

## **6. Oral Exam**

### **A. Focus**

The oral exam tests the student's ability to reason analytically and to develop ideas and defend them in front of other scientists. Thus, the emphasis is on hypothesis testing and experimental design. The student should be familiar, however, with the key past experiments performed that led to the hypothesis and the important basic concepts of the approaches to be used (i.e. if studying a membrane receptor, the student must know aspects of that receptor binding, whether the cell type is appropriate for studying that receptor, whether antibodies or cDNAs have been made to that receptor). Committee members expect students to be familiar enough with each technique proposed to understand its theoretical basis, as well as its appropriateness and limitations in addressing the hypothesis being tested. However, detailed knowledge of such things as buffer ingredients and incubation times are less important, unless they are vital to the interpretation of the results. For example, if one proposes to use PCR, one should know how PCR works, whether the necessary starting materials are available, whether PCR is the best approach to address the question being asked, and the limitations of using PCR. One does not need to know the exact ions needed for the PCR reaction to take place, nor the incubation time of the step. In contrast, if one were studying ion channels, one would be expected to know the ion concentrations in the buffers to be used to measure ion transport.

### **B. Format**

Each student's file is provided to the Prelim Committee Chair by the CMB Administrator one day prior to the exam. At the start of the examination the student will be asked to leave the room for a few minutes while the examining committee has a chance to discuss the student's record, issues related to the proposal, and how they wish to organize the examination. The student will then be asked to give a 15-20 minute oral presentation. This presentation typically starts with the hypothesis, specific aims, and a few sentences pertaining to the significance. However, the emphasis should be on the experimental approaches to be taken to address the hypothesis. The members of the committee might wait until the presentation is over, or might ask questions as points are presented. The examination and questions usually last approximately 2 hours.

It is expected that the students will have a fairly deep understanding of any experiments proposed and how to interpret them, as well as a solid grasp of the key literature in the field of inquiry. Furthermore, the curriculum for all CMB students is based on a solid foundation in biochemistry, genetics and cell biology, and students should demonstrate a breadth of knowledge in these areas if relevant coursework had been completed. At least some of the questions from the committee should address the extent to which the student can think independently of the proposal using their knowledge in these areas.

### **C. Evaluation**

When all committee members have had the opportunity to ask all the questions they wish, the student will be asked to leave the room. The committee will then discuss whether the student has displayed sufficient depth and breadth of scientific knowledge, insight into experimental design, and ability to think critically, analytically and quantitatively, to predict a high likelihood of success in pursuit of a Ph.D. thesis.

For the outcome of the Prelim, the written and oral exams will be evaluated separately by the Committee. A student will either pass or fail each component (Written and Oral). If a student fails either or both exams – the Committee will decide whether the student can rewrite/re-present the exam one time, or recommend to the CMB Program Committee that the student should be dismissed from the CMB Program. It is not unusual for CMB prelims that students are asked to rewrite part, or all, of the written proposal, or occasionally to retake the exam with the same problem, or with a different problem. The committee and student should keep in mind that the examination is a learning experience, and that students who retake the exam usually improve immensely the second time. If there is a serious question as to whether the student should pass, it is recommended that the student be asked to retake the examination.

Immediately following the examination, the chair of the Prelim Committee should indicate the outcome and discuss with the student the strengths and weaknesses of the performance on the prelim. A summary of the exam outcome including strengths and weaknesses is prepared by the Prelim Committee chair and is provided to the student and the mentor. The chair writes the summary of the examination on the form provided by the CMB office. All of the committee members sign the form, which is returned promptly (within one week) to the CMB office as well as to the student and mentor. The report and outcome of the Preliminary Exam comprise a recommendation to the CMB Program Committee as part of the consideration of the student for advancement to candidacy for the Ph.D.

### **ADVANCEMENT TO CANDIDACY**

The final approval as to whether the student is advanced to candidacy will be made by the faculty members of the CMB Program Committee, and will incorporate the totality of the student's record. Each student's academic record and laboratory progress are reviewed by the Director and the CMB Program Committee after the student takes the preliminary exam. The Prelim Exam summary statement, together with information from the student's file relating to performance in courses, research rotations and dissertation work will be included. Factors considered in determining a student's eligibility for advancement to candidacy include: (a) academic record meets Rackham requirements (average of B or better), (b) required CMB coursework (biochem, cell biology, genetics) has been accomplished with grades of B or better, (c) laboratory progress is satisfactory based on completion of rotations and satisfactory reports from the dissertation mentor. The student's dissertation mentor is asked to write a detailed evaluation of the student's performance in conjunction with the review for advancement to candidacy. If clarification is needed, the student's dissertation mentor or prelim committee chair may be asked to attend the Program Committee meeting when the student's performance is discussed. If deficiencies are identified, the Program Committee will recommend procedures for correcting the deficiencies to bring the student to eligible status before that student advances to candidacy.

Once the Program committee decides to advance the student to candidacy, the CMB Office will process the candidacy with Rackham. Students must register for Fall and Winter terms after advancing to candidacy. Additional requirements can be found on Rackham's Doctoral Degrees policy page ([http://www.rackham.umich.edu/policies/academic\\_policies/section5/](http://www.rackham.umich.edu/policies/academic_policies/section5/)).

### **DISSERTATION COMMITTEE AND THESIS RESEARCH**

The dissertation committee guides the research project of the student. The committee is **appointed within one month** after the student achieves candidacy, and **meets within six months after the student achieves candidacy, and every six months thereafter**. The committee advises, guides and reviews the thesis progress. The dissertation mentor chairs the Committee, which includes at least 3 additional members, each of whom must be affiliated with a Ph.D. program. At least two members of the committee in addition to the chair must be members of the CMB Program faculty. Students should submit the names of proposed thesis committee members and a full abstract of the proposed project for approval by the CMB Program Committee.

**Thesis committee meetings take place every six months.** Students must advise the CMB office when each thesis committee meeting is scheduled. Although not required, students and committee members often find it useful if a student prepares and distributes a brief summary/outline for the meeting, which may include recent data. The chair of the dissertation committee (thesis mentor) submits a report of each thesis committee meeting within two weeks after each meeting. This report is reviewed and signed by both mentor and student before being reviewed by the Program Director.

Upon approval by the thesis committee, the student writes a scholarly thesis formatted according to the Rackham guidelines. Published manuscripts are often included as chapters in the thesis. In addition, a scholarly introduction and discussion are typically included to provide an integrated dissertation. The thesis is defended at a public seminar followed by a meeting with the thesis committee. Students must be registered for the semester in which the thesis is defended. The Rackham website should be consulted for detailed instructions regarding the PhD dissertation and other information related to graduate training (<http://www.gradtools.umich.edu/>). CMB students are expected to attend at least four CMB thesis defenses each academic year.

## **TEACHING**

All CMB students are required to participate as a teaching assistant (TA, GSI) for one term, generally teaching shortly after achieving candidacy. The CMB Program Committee provides a list of courses appropriate for CMB students to teach. As a minimum, students are expected to attend lectures, prepare material to present in a formal class context (review session or lecture), and to participate in student evaluation (exams). The teaching requirement must be fulfilled prior to completion of the degree. A CMB faculty member serves as Teaching Coordinator. That faculty member and/or the CMB Program Administrator act as liaisons with the contributing departments and assist students in securing teaching positions. Once a teaching position is arranged, the student submits to the CMB office the name of the course and the course director. Directors of courses in which CMB students teach submit a written description of teaching activities and evaluation of the student's performance at the end of the course. Institutional teaching awards recognize excellence in teaching, indicating the value placed on learning these skills.

## **Special Research and Career Training Activities in CMB**

**Annual CMB Symposium and Poster Session.** A centerpiece of the CMB Program is the Annual Symposium and Poster Session at the start of each academic year. The Symposium opens with a keynote address by a prominent scientist whose work represents landmark contributions in cellular and molecular biology. The keynote address has been named "The Myron Levine Lectureship" in honor of former CMB Director Myron Levine. Immediately following the lecture, CMB students and faculty participate in a dynamic poster session. The Rackham Graduate School provides awards for the top three poster presentations; students present their posters to CMB faculty judges as they would at a national meeting. The well-attended CMB poster session also provides an opportunity for incoming students and others in the University community to find out about research in the laboratories of CMB faculty.

**CMB Retreat.** The CMB Retreat encourages students and faculty to interact in an informal setting to promote scientific collaboration and collegiality within the program. The retreat occurs over a weekend in the spring at an off-site location. Senior-level students give short formal research presentations, as they would at a national meeting, while less senior graduate students have the opportunity to present their work during poster sessions. Outside speakers are also invited to discuss their research and career paths. Activities such as a talent show, group sports, and free time allow students and faculty to socialize in an informal setting.

**Student-Faculty Networking Lunches.** CMB students and faculty with common research interests meet informally during the academic year to discuss issues in science. The five research interest areas are: (1) Cells

and systems biology, cell physiology, biochemistry and structural biology (2) Genetics/gene regulation, genomics/proteomics, computational biology; (3) Microbial pathogenesis, immunology; (4) Development, aging, neurobiology; (5) Molecular mechanisms of disease, cancer biology. The unstructured format of these meeting allows those in attendance to guide discussion topics and allows students and faculty with common research focuses to develop relationships.

**Career Development Workshops.** During the Fall semester, two workshops on “the basics” are presented: “How to present a research seminar” is demonstrated at the first session of the CMB student seminar (CMB 850) each year by the Course Directors, and “How to write a research grant” is presented just prior to the time when students are preparing prelim proposals and writing fellowship applications. During the winter term, special topics of relevance to graduate students have been presented, such as “Preparing an effective CV,” “How to apply for a postdoc,” “How to get the most out of a scientific meeting,” and “Critical preparation and review of manuscripts.” These informal sessions complement Career Workshops organized by PIBS and by Rackham; their smaller size allows more open discussion.

**Student-to-Student Mentoring.** The CMB Program sponsors “Students Mentoring Students,” an informal mechanism for senior CMB students to mentor students entering CMB from PIBS or MSTP. In this way, students in different labs and different parts of the campus get to know one another better. The mentoring student and incoming student have opportunities for informal and self-directed interactions such as discussion of academic issues, administrative issues, lab issues or other topics of interest. The mentoring program is inaugurated at an informal reception for all CMB students early in the academic year.

Other informal social events are organized by CMB students and/or the CMB office throughout the academic year. CMB students are also strongly encouraged to participate in the annual graduate student recruitment weekends each year.

**Travel to scientific meetings.** The CMB Program encourages students to present their work at local, regional, and national scientific meetings. The Program provides a contribution to expenses for student travel to scientific meetings upon request to the CMB Administrator and approval by the CMB Director. Students can also apply to Rackham for travel support.

**Student Funding.** CMB students in good standing receive full financial support during their studies, according to PIBS policy. Support is provided for tuition, stipend, and individual health insurance. Support for the first ten months is provided by PIBS. MSTP students are supported for 36 months while in a dual degree program. Beyond this, funding is the responsibility of the thesis mentor. Most mentors encourage students to apply for fellowship support, some of which is available by application to CMB. CMB funding awards are based on student merit. When funding awards do not cover the full stipend amount, mentors are responsible for covering the shortfall to bring the stipend to the PIBS level. In accordance with NIH policy, students may not be supported longer than 7 years.

## **Policies on Student Employment, Vacations, and Absences**

**Student Employment Outside the Program.** The CMB Program follows NIH policy that students may not be employed outside their training program. The CMB faculty believe that Ph.D. training is a full-time endeavor. Outside employment subtracts from the time and mental energy a student devotes to his or her research. No student in the CMB Program may be employed outside the Program without permission of both the mentor and the Program Committee.

### **Vacation, Leaves of Absence**

Participation in the CMB Program, without regard to the source of financial support, is to be full time; that is, 12 months per year. Participation includes regularly scheduled Program events and registration in the graduate school for relevant course work, directed research and dissertation research. Other relevant activity such as detached study, or other off-campus course work may be taken with the Director's approval in consultation with the Program Committee and research mentor. Other activity will be viewed as personal and may be undertaken subject to the following policy covering Vacations, Leaves and Absences.

**Vacations.** Students are entitled to time off during vacation periods, such as University-designated holidays, winter and spring breaks, and may request time off during the summer. Students must discuss proposed vacation periods with their mentors well ahead of time, and vacation time is expected not to exceed 4 weeks per year, including all University breaks and mentor-approved vacations. Any further vacation time should have the additional approval of the CMB Director, and it may be granted without financial support. Since progress towards completion of dissertation studies is normally directly related to the amount of time devoted worked in the lab, it is highly recommended that students enrolled in classes take advantage of time off from classwork to make progress in the laboratory.

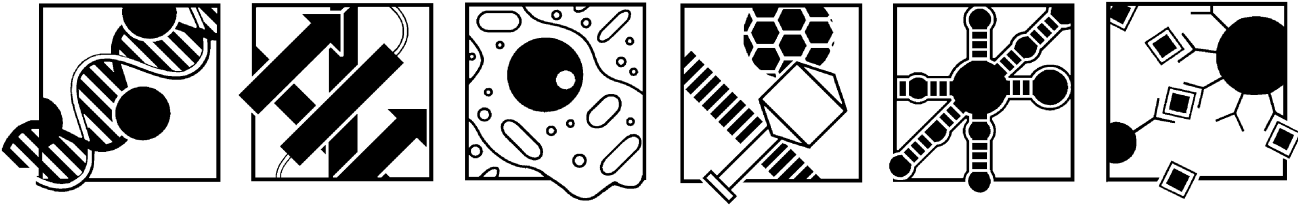
**Leaves of Absence.** Ph.D. students who need to suspend all work toward their degrees temporarily for reasons of health, dependent care, family needs, or military service will be able to apply for a Leave of Absence. In addition, Ph.D. students may take a limited Leave of Absence for personal reasons. During the period of the leave, students will be considered to be active in the Ph.D. program but will not have to register and are not expected to make progress on their degree work. Students can apply for a leave of up to 12 months; when circumstances persist, most leaves can be extended to a total of 24 consecutive months. However, students are limited to one term of personal leave during their Ph.D. studies. All requests for Leaves of Absence must be submitted to Rackham via website (below) and are reviewed by the CMB Program Director and CMB Program Committee. A formal letter indicating the duration of the leave is kept in the CMB office.

While on a Leave of Absence, students are eligible for limited University services. At the conclusion of a leave, students will automatically return to active study status. Funding and other commitments made to students prior to the leave will carry over and are available as they resume active work toward their degrees.

Information and materials on the Leave of Absence process for program students, faculty, and staff are available on Rackham's website ([http://www.rackham.umich.edu/current\\_students/doctoral\\_students/phd\\_students/leave\\_of\\_absence/](http://www.rackham.umich.edu/current_students/doctoral_students/phd_students/leave_of_absence/)), and include the electronic application form. For specific questions about Leaves of Absence, contact the Leave of Absence Coordinator by e-mail [rackham.loa@umich.edu](mailto:rackham.loa@umich.edu) or call (734) 647-2640.

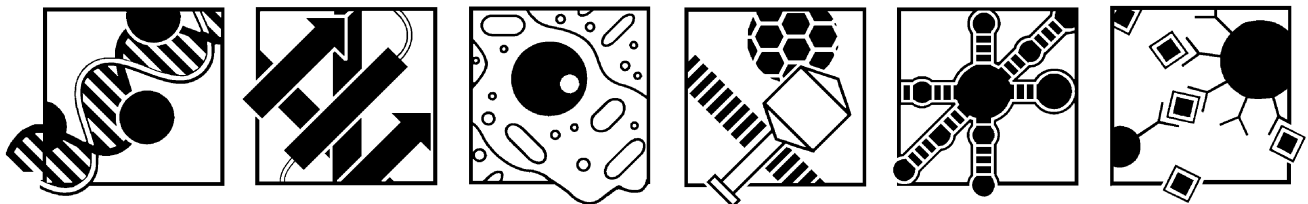
**Parental Accommodation Period (Maternity Leave).** All eligible students will be granted a Parental Accommodation period up to six weeks long immediately following the birth of a child or the adoption of a child under the age of 6 for whom the student has parental responsibilities. During this period of accommodation, the student will continue to be enrolled as a full time student. Additional information can be found at the following Rackham website:

[http://rackham.helpserve.com/index.php?\\_m=knowledgebase&\\_a=viewarticle&kbarticleid=47&nav=0](http://rackham.helpserve.com/index.php?_m=knowledgebase&_a=viewarticle&kbarticleid=47&nav=0).



# **CMB HANDBOOK STUDENT COMMITTEE SUPPLEMENT**

**2010 Edition**



### **Program Committee**

Two positions to represent the CMB student body at Program Committee meetings. The Program Committee meets every two months throughout the year to discuss admission of incoming students and faculty members, course requirements, preliminary exam requirements, recruiting, CMB funding, approval of dissertation committees, and many other items pertaining to the continued growth and success of the CMB program. Special meetings, especially during the recruiting period near the beginning of the year, are also required as part of this position.

### **Short Course Organization Committee (Fall)**

Two or three students plan the Fall short course, which is held in conjunction with the Genetics Training Program. These students, with the aid of a faculty advisor, select the short course topic and invite outstanding leaders in the field to participate as speakers in the short course. They also help in coordinating the seminar times/locations and student lunches with the speakers. General guidelines/timelines are available from the CMB office to assist in planning the seminar, which requires advanced preparation to secure a good panel of speakers. This committee works best if all of the members of the short course committee have similar research interests, and is an excellent opportunity to meet top researchers in that field!

### **CMB Retreat Committee**

Four CMB students work with two faculty coordinators with the planning and scheduling of the annual retreat, which is a weekend in mid-May. This includes finding the location, getting a keynote speaker, and creating activities.

### **CMB Symposium Committee**

Two CMB students are needed to assist the faculty coordinator with the Fall CMB Symposium. This includes coordinating the CMB Poster Session, which follows the Myron Levine Lecture.

### **Student-Faculty Networking Lunches Committee**

Two students work with two faculty coordinators scheduling dates for students and faculty to gather in an informal lunch. Groupings are based on common interest in one of the five research areas listed in CMB. Students host the lunch and coordinate suggestions for discussion questions from students

### **Student Advisors for the Academic Advisory Committee**

Two-four students are available at the same time as the faculty advisors to advise pre-candidates on course choices, rotations, student seminars, and prelims. Meetings with pre-candidates occur twice a year, and advisors must themselves have achieved candidacy. It is preferable to have at least one student advisor be a former PIBS student since incoming students now come through PIBS.

### **Recruitment Committee**

Persons from this committee, together with the Program and Social Committee members, help to coordinate the CMB activities during the PIBS recruitment weekends, as well as the visits of recruits who visit Michigan on alternate weekends. The duties of this committee include assigning student recruits to CMB student hosts, assigning/selecting restaurants and nighttime activities for the weekend, planning CMB program presentations (e.g. poster presentations), etc. This is approximately a 2-month commitment during which meetings occur approximately every 2 weeks.

### **Recruiting Program Coordinators**

During recruiting season (Jan-Feb), two students to help organize the presentations at the lunch and reception each recruiting weekend, where students and faculty make presentations about CMB to visitors. (Line up speakers, host the presentations, set up powerpoint/audiovisuals).

### **Social Committee**

Consisting of 3 students who are in charge of scheduling CMB student gatherings and social outings. These gatherings in the past have included the Welcome Picnic for students and faculty, monthly birthday gatherings, and many other events. Activities could include-but are not limited to-bowling nights, ice skating, gatherings at a local bar, birthday celebrations, etc. The goal of this committee is to promote and facilitate camaraderie between CMB students. Some funding may be obtained for these events from the CMB program. Committee members also play a limited role in planning activities related to recruitment and the Fall Symposium.

### **CMB Newsletter Editor/Coordinator**

Two students serve as editors of the biannual CMB Newsletter. This can be spearheaded by multiple students who are willing to create a 4-6 page newsletter keeping the CMB faculty and students abreast of various CMB activities and important events or accomplishments in the lives of faculty and students alumni. The newsletter has also been added to the CMB web site, particularly for the purpose of recruitment outreach and contact with alumni.

### **CMB Website Committee**

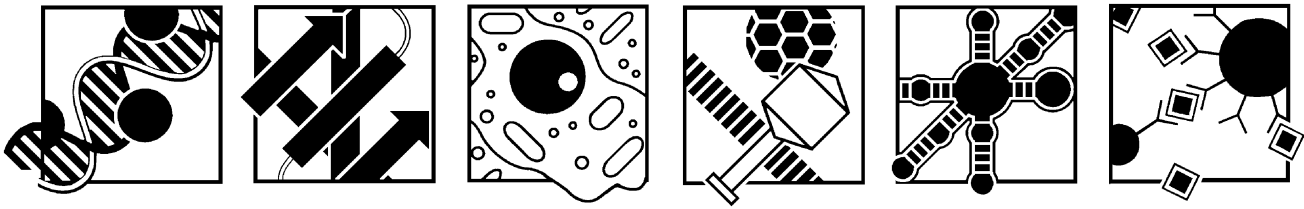
Two students will be in charge of monitoring the CMB website for necessary updates, including addition of new students, who have graduated, and updating the calendar, as well as reviewing overall content for accuracy, relevance, and user-friendliness. Students will also coordinate acquisition of photos for student profiles. Ideally, at least one of these students will be familiar with website maintenance so they can help with updates and monitor website performance using Google Analytics.

### **CMB event photographers**

One or several students who like to take photos, take responsibility to do so at CMB events. CMB can provide the digital camera.

### **Graduate Student Council Representatives**

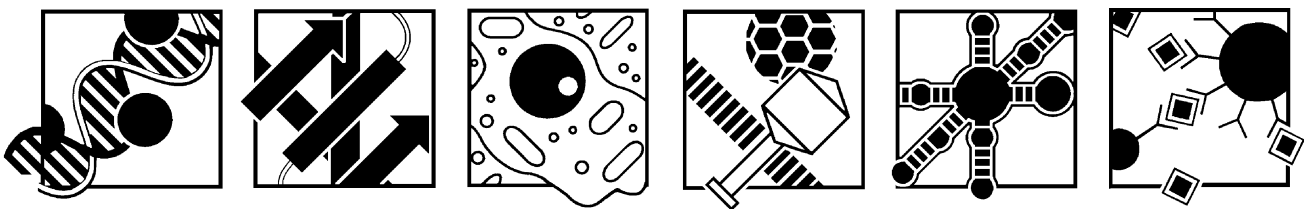
Two students are chosen to be the CMB representatives to the Graduate Student Council (GSC). GSC coordinates various activities throughout the year, including the Fall Welcome Picnic and other social events such as the golf outing and bar nights. These students also serve to represent the CMB program to Rackham when student meetings are held. These meetings occur semi-monthly.



# CMB HANDBOOK

## FACULTY SUPPLEMENT

2010 Edition



## **ACTIVITIES FOR ALL CMB FACULTY**

### **Attend CMB 850 – Student Seminar**

CMB 850 is the student seminar course that meets each Monday, 12-1pm (lunch is provided), from September through May. Entering students (2<sup>nd</sup> yr PIBS, 1<sup>st</sup> yr MSTP) present journal articles, in some cases based on the topic of Short Course that semester. Senior students present their research; they often invite faculty members of their thesis committees to attend. Students also serve as moderators of discussion and evaluators of presentations.

All CMB faculty are scheduled to attend at least three CMB student seminar presentations during the academic year, should participate in the discussion, and sign the attendance sheet. Attendance dates for faculty are assigned at beginning of academic year. If a faculty member cannot attend on assigned date, it is expected that he/she will attend on another convenient date.

### **Preliminary Exam Committees (4 faculty/committee)**

All CMB faculty are expected to serve on CMB preliminary examination committees when asked, either by student or by Prelim Coordinators. Prelim Exams are scheduled during a two-week period, generally mid-late Feb or early March. Faculty on prelim committees are expected to provide constructive feedback to students within a week of receiving the student's abstract, and within a week of receiving the prelim proposal. Feedback can be communicated directly to student, or via the Prelim Exam Committee Chair appointed by the Prelim Exam Coordinator.

### **Thesis Exam Committees (4-5 faculty/committee for each candidate student)**

All CMB faculty are expected to serve on CMB thesis committees when asked by students. The first thesis committee meeting occurs within 6 months of a student being advanced to candidacy. Regular thesis committee meetings then occur every 6 months, or more frequently when a committee so advises. Thesis committee members receive the thesis 10 days prior to the scheduled defense, and submit an evaluation to Rackham 3 days prior to defense. The thesis defense consists of a public seminar, followed by a private defense with members of the thesis committee.

### **CMB Program Events and Activities**

Annual CMB events include the: Welcome Barbecue (August), Annual Symposium and Poster Session (first week Sept), CMB events (dinners and reception) during PIBS Recruiting weekends (Jan-Feb), CMB and Genetics short courses (fall and spring), and the CMB Retreat. Additional activities throughout the year include faculty-student lunches, as well as a variety of dinners, receptions and open houses for CMB events and social events planned by students.

### **Student-Faculty Lunches (multiple faculty)**

CMB students and faculty get together informally each month to discuss common research interests. Small groups of students and faculty are identified based on their research interests and meet over lunch throughout the academic year. The sessions provide a point of departure for lively discussion of scientific, career-related and other issues of interest in a non-structured setting. The series is coordinated by CMB faculty and the current research groupings include: A) Cell and systems biology, cell physiology, biochemistry and structural biology; B) Genetics/gene regulation, genomics/proteomics, computational biology; C) Microbial pathogenesis, immunology; D) Development, aging, neurobiology; E) Molecular mechanisms of disease, cancer biology. Notices for these lunch meetings are sent out and require an RSVP to the CMB office ([cmbgrad@umich.edu](mailto:cmbgrad@umich.edu)).

## **ADDITIONAL ACTIVITIES FOR CMB FACULTY**

### **Overview (descriptions below)**

#### **Courses and Curriculum**

CMB 850 (Student Seminar) – Directors, Evaluators, Attendees

CMB 630 (Short Course) – Coordinators

PIBS Curriculum Committee Representative

PIBS 503 – Research responsibility course discussion leader

Pharm 502 – Grant writing course section leader

#### **Student Training**

Preliminary Exam Coordinators

Preliminary Exam Committees

Thesis Exam Committees

Teaching Coordinators

Academic Advising

Fellowship Appointments and Awards

Career Development Workshops

#### **Recruiting new students**

PIBS Admissions

CMB Admissions

CMB Recruiting activities

Diversity recruiting

#### **CMB Program Events**

CMB Annual Symposium – Coordinators and Poster Judges

CMB Retreat Coordinators

Student-faculty lunches

#### **Faculty Affairs**

New Faculty Lunches

Faculty Review

#### **Communications**

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Program Committee

## **DESCRIPTIONS OF ACTIVITIES FOR CMB FACULTY**

### **Courses and Curriculum**

#### ***CMB 850 – Student Seminar (20 faculty total)***

CMB 850 (described on p. 10) is the student seminar course that meets each Monday, 12-1pm, from September through May.

#### ***CMB 850 Course Directors (2 faculty)***

Two CMB faculty coordinators share responsibility for attending the weekly seminars. They also develop the schedule for student presentations, rehearsals and evaluations, composing the full year schedule during the summer before. The Seminar Course Directors are responsible for recruiting faculty to serve as seminar and rehearsal evaluators. The Directors also monitor student attendance, and grade students with a grade of “S” or “U”.

#### ***CMB 850 Evaluators (18 faculty)***

Each week, a CMB faculty evaluator provides feedback to CMB student presenters on their seminars, either during the preparation phase (***Rehearsal Evaluators***), usually the Friday preceding seminar, or at the final seminar on Monday (***Seminar Evaluators***). Course Directors recruit the team of Evaluators, and work with faculty to determine convenient dates for them to serve as Evaluators, arranged at the beginning of the academic year. Each Evaluator attends either a rehearsal or seminar, approximately five times during academic year. The Rehearsal Evaluator attends the rehearsal, with mentor present, and provides feedback to student for preparing and delivering a professional seminar presentation. The Seminar Evaluator stays briefly after the seminar to provide oral feedback on the seminar, and completes a brief form summarizing evaluation that is shared with student and submitted to CMB office.

#### ***CMB 630 – Short Course Faculty Coordinators (1-2 faculty)***

The CMB Short Course is a minisymposium on a topic selected by students, who invite speakers and organize the course, which takes place during the Fall term. Faculty Coordinators (1-2) are selected by student organizers to work with them to plan and implement the Short Course. Students work with faculty coordinators to invite four speakers to participate in the Short Course. Faculty coordinators present an introductory seminar on the topic of the Short Course, and help coordinate visits. Coordinators often meet with the invited speakers for dinner. Coordinators are also responsible for grading registered students with a grade of “S” or “U”. The Short Course is co-sponsored by the Genetics Training Program, and students in that Program organize the winter Short Course.

#### ***CMB Representatives to PIBS Curriculum Committee (1-2 faculty)***

Curricular issues for the 13 participating graduate programs are coordinated through PIBS. CMB students take an individualized program of didactic courses that are offered by Departments and Programs throughout the University. Each graduate program, including CMB, identifies one or two faculty representatives to the PIBS curriculum committee, which meets 1-2 times per year, as needed.

#### ***PIBS 503: Research Responsibility – small group discussion leader (1 faculty member)***

The Research Responsibility course, which takes place each Fall term, is now online, including PodCasts. The material is accompanied by a required set of small group discussions. Faculty from all graduate programs, including CMB, participate in conducting small group discussions, by arrangement with the Course Director. The discussions are often scheduled as a cluster, including on Saturday.

#### ***Pharm 502: Grant Writing – small group session leader (1 faculty member)***

The Grant Writing Course, which takes place during Winter term, involves lectures and small group sessions. Faculty from all graduate programs, including CMB, participate in conducting small group discussions, by arrangement with the Course Director.

## **Student Training**

### ***Preliminary Exam Coordinators (2 faculty)***

Prelim Coordinators work with students and their mentors to ensure that students complete their preliminary exams in a timely fashion according to the deadlines put forth by the Program Committee. The coordinators approve the topic for the prelim exam. Students select two CMB faculty to serve on their prelim committees, and the prelim coordinators arrange for two additional faculty for each prelim committee, and identify one of the faculty members to serve as committee chair. Typically, each prelim coordinator works with 7-8 students.

### ***Preliminary Exam Committees (4 faculty/committee)***

All CMB faculty are expected to serve on CMB preliminary examination committees when asked, either by student or by Prelim Coordinators. Prelim Exams are scheduled during a two-week period, generally mid-late Feb or early March. Faculty on prelim committees are expected to provide constructive feedback to students within a week of receiving the student's abstract, and within a week of receiving the prelim proposal. Feedback can be communicated directly to student, or via the Prelim Exam Committee Chair appointed by the Prelim Exam Coordinator.

### ***Thesis Exam Committees (4-5 faculty/committee for each candidate student)***

All CMB faculty are expected to serve on CMB thesis committees when asked by students. The first thesis committee meeting occurs within 6 months of a student being advanced to candidacy. Regular thesis committee meetings then occur every 6 months, or more frequently when a committee so advises. Thesis committee members receive the thesis 10 days prior to the scheduled defense, and submit an evaluation to Rackham 3 days prior to defense. The thesis defense consists of a public seminar, followed by a private defense with members of the thesis committee.

### ***Teaching Coordinators (2 faculty)***

CMB students are required to teach for one semester. They generally teach during the year after being advanced to candidacy. Two CMB faculty members serve as advisers on teaching opportunities for students, and often serve as liaisons to departments that are seeking TAs and GSIs.

### ***Academic Advising (2 faculty)***

CMB faculty members familiar with course offerings meet with students prior to course registration (generally July, Aug/Sept, and Nov), to advise them on course selections in the context of PIBS and CMB.

### ***Fellowship Appointments and Awards Committee (3 faculty)***

Appointments to the CMB Training Grant are recommended by the Fellowships and Awards Committee. Students selecting CMB for the PhD Program submit materials (research statement, transcript) in conjunction with their mentors. The call for nominations occurs in the Spring, and selections are made prior to the anniversary of the Training Grant (July 1).

CMB students have been recipients of national, University and Medical School Awards. The Awards committee reviews nominations for awards several times during the year. These include: the CMB Training Grant and Rackham Regents Fellowship (July), Medical School Research, Teaching and Service Awards (August), national Harold M. Weintraub Award (Nov), Rackham Predoctoral Fellowship (Nov), Distinguished Dissertation Award (Nov), Outstanding GSI Award (Nov). Committee members draft nomination letters as needed.

### ***Career Development workshops – coordinator (1 faculty member)***

CMB presents a number of workshops for students on topics pertinent to career development. During Fall term, the first session of CMB 850 provides guidelines and tips on how to give an effective scientific seminar. Prior to preliminary exam period, CMB organizes a workshop on how to write a grant. During winter term, several workshops are presented on relevant topics, such as how to look for a postdoc, how to write a cv. The coordinator of the career workshops recruits faculty to participate in the presentations.

## **Recruiting New Students**

### ***PIBS Admissions Committee, CMB Representatives (4 faculty)***

From November through December, PIBS receives applications to review, and posts them on-line. CMB reviews the applications for students selecting CMB as primary or secondary department choice, to decide which applicants to invite for recruiting weekends. The PIBS Admissions Committee meeting in Dec or Jan is attended by four faculty members from each of the 13 PIBS Programs, including CMB. The PIBS admission committee may meet again a day or so after each recruiting weekend to decide which students receive offers.

### ***CMB Admissions Committee (4 faculty)***

CMB Admissions Committee has a meeting for internal review of our applicants a day or two before the PIBS meeting. The committee is composed of 6 faculty members and 6 students, including the faculty representing CMB on the PIBS Admissions Committee. After each recruiting weekend the CMB Admissions Committee meets once interview evaluations have been submitted (1-2 days later), to rank applicants for making offers.

### ***CMB Recruiting Activities (multiple faculty)***

During PIBS recruiting weekends (Jan-Feb), CMB faculty have opportunities to interview applicants individually (followed by submitting written evaluations), to attend a reception to meet all applicants interested in CMB, to attend small group dinners with applicants, and to participate in an Open House. Some faculty will also have an opportunity to make brief presentations to applicants during lunch and receptions for applicants. Students often arrange research rotations with faculty whom they meet during Recruitment weekends.

## **CMB Program Events**

### **CMB Annual Symposium**

#### ***Coordinator (1 faculty member)***

A CMB faculty member invites a prominent scientist to present the Myron Levine Lecture at the Annual CMB Symposium during the first week of September. Invitations are arranged at least one year ahead. The CMB faculty member then hosts the Levine Lecturer during his/her visit. The CMB Office arranges the speaker's schedule, including a lunch with students and generally dinner with faculty members.

#### ***CMB Annual Symposium Poster Session Coordinators (2 faculty)***

The CMB Poster Session immediately follows the Levine Lecture and is attended by all CMB students and faculty laboratories. The primary responsibilities of the Poster Session coordinators take place during the month of August. The key responsibility for this position is organizing the judging of all of the student posters. The coordinators recruit a panel of judges (usually around 8-10), determine the timing of student presentations of their posters, and assign judges to evaluate specific posters. The evaluation of the posters takes place during the morning before the poster session. The coordinators assemble the rankings and provide information for presentation of Poster Awards. The coordinators also run the program at the Poster Session when Awards are presented.

#### ***CMB Annual Symposium Poster Judges/Evaluators (8-10 faculty)***

A team of 8-10 CMB faculty serve as judges of posters submitted by CMB students for the annual Poster Session (Sept). The judges listen to students present their posters, and select the top three posters for awards provided by the Rackham Graduate School. The judging takes place during the morning before the public Poster Session.

### **CMB Annual Retreat**

#### ***Retreat Coordinators (2 faculty)***

The CMB Retreat facilitates interactions between students and faculty in an informal setting at an off-site location, generally during a weekend in May. Students in their fifth year or above give short formal research presentations while less senior students can present their work during poster sessions. Various activities are planned to allow students and faculty to socialize in an informal setting. The CMB Retreat Coordinators work

with students on the committee to develop the Retreat Program and insure dynamic, educational and enjoyable interactions among students, speakers and invited faculty participants.

### **Faculty Affairs**

#### ***New Faculty Lunches – Coordinator (1 faculty member)***

PIBS coordinates lunches during the Fall term where faculty in the 13 PIBS programs present their research to first year PIBS students and MSTP students who are still arranging research rotations. One CMB faculty member coordinates the CMB faculty presentations by contacting new faculty, assigning dates for presentation, and serving as Chair of the session when CMB faculty members make presentations.

#### ***Faculty Review (6 faculty)***

CMB faculty members are reviewed every 5 years; new CMB faculty members are reviewed 3 years after their appointment. The Faculty Review is conducted by a Committee of 6 faculty members who serve staggered 3 year terms. At the time each faculty member is being reviewed, she/he fills out a questionnaire documenting participation in Program activities, and also provides an updated NIH Biosketch, including publications and grant support. The Committee evaluates participation and resources to support students financially, to determine eligibility for continued membership in CMB. The Committee summarizes their evaluations and makes recommendations to Program Committee.

### **Program Communications**

#### ***Newsletter (1 faculty member)***

The CMB Newsletter is printed twice a year, generally in the fall term during the CMB Short Course and in May in conjunction with the Research Forum. Student editors prepare and assemble the newsletter. The faculty coordinator works to keep the students on track and edit the newsletter before printing.

#### ***Website (1-2 faculty)***

To keep the CMB website current and up to date, 1-2 CMB faculty members, working in conjunction with a designated CMB student(s) and the CMB Office, monitor the website and recommends updates.

### **Administration and Policy**

#### ***Program Committee (12-15 faculty)***

The CMB Program Committee is the policy-making body of CMB and is comprised of approximately 12 faculty from departments represented among CMB faculty and students, and Directors of PIBS and MSTP. Students are also elected by students to serve on this committee. The CMB Program Committee meets every other month to discuss student issues, faculty issues (including review of faculty applications), and program policies and procedures. Faculty are selected by the Director to serve 3 year terms on the CMB Program Committee and responsibilities are ongoing.

### **APPLYING FOR MEMBERSHIP IN CMB**

Faculty applications are reviewed directly by the CMB Program Committee in an attempt to ensure that faculty members have appropriate resources, projects, and scientific training to provide a strong training environment for Ph.D. students.

#### ***The following are expected:***

- Active research program and peer-reviewed publications in the area of cellular and molecular biology.
- Evidence that the applicant will provide outstanding mentorship to graduate students.
- Sufficient external funding to support a student and the student's research. For newly hired faculty, start up funds may also be considered if there is a letter of support from the department chair pledging financial support for the student should there be a lapse in funding.

#### ***To evaluate the above, faculty applicants should provide:***

1. A cover letter from the faculty member, describing what type of projects might currently be available for a Ph.D. student; if any students and postdoctoral fellows have already been mentored, a description of how these experiences turned out and where the students/postdocs are now would also be useful.
2. A CV or NIH-style biosketch describing training, professional history and publication record.
3. A description of current research support (NIH-style "Other Support" format is OK). Major competitive grant support is considered an important indicator of training resources, since CMB students are not expected to teach to support themselves after they are supported by PIBS/CMB. Please indicate all of the internal and external resources that you will have available to support a doctoral student and the student's research. If you do not have external support, indicate how you will budget your resources (including start-up) to reserve funds for support of a student and the student's research. If funding status is an issue, a letter from the department chair is needed stating that funds will be provided by the department during funding gaps, if needed, to support training of students until thesis defense.
4. An NIH-style "Resources and Environment" statement describing the physical facilities available to the faculty member.
5. A one-page (maximum) statement of the faculty's research interests, to be used in the NIH training grant, the CMB brochure and website. Include a "one-line" (1-2 phrases) description of your research area as a title.
6. Two letters of reference from current faculty members of CMB. Current CMB faculty are listed on the CMB website.

Faculty applicants should feel free to call the CMB Office (734 764-5428) if they have any questions about the CMB Program or details in the application process. Materials can be sent directly to the CMB office (2966 Taubman Medical Library, Box 5619, email: [cmbgrad@umich.edu](mailto:cmbgrad@umich.edu)).

## **CMB FACULTY REVIEW**

The CMB Faculty Review Committee (FRC) reviews a subset of the CMB faculty each year. The FRC is composed of six faculty members appointed by the CMB Director, who serve staggered 3 year terms. The FRC does not have formal student representation. However, students who would like to provide constructive input regarding CMB faculty are encouraged to do so either through the two student representatives on the Program Committee or by contacting the CMB Director.

New CMB faculty members are reviewed 3 years after their appointment. Other faculty are reviewed every 5 years. Approximately one-fifth of the CMB faculty is reviewed each year. Criteria for continued membership in CMB which the FRC will consider to evaluate faculty include: attendance at CMB 850; participation in the various CMB educational activities such as mentoring thesis students, being on CMB thesis committees and CMB prelim committees; serving on other CMB committees; and presenting a poster at CMB events such as the Fall Symposium.

Faculty participation will be documented by faculty sign-in at CMB 850 each week. In addition, once per year, all CMB faculty will be asked to fill out a brief annual participation questionnaire which is designed to take only about a minute to complete.

### **Minimum faculty participation** (detailed descriptions in ACTIVITIES FOR ALL CMB FACULTY section above):

- attend the CMB student seminar series (CMB 850) at least three times per year. Attendance dates are assigned for faculty convenience; faculty who cannot attend as assigned can choose alternate dates.
- attend the annual CMB Symposium and Poster Session (first week Sept)
- serve on preliminary examination committees when asked
- serve on thesis committees when asked

### **Other opportunities for CMB faculty participation include** (detailed descriptions in ADDITIONAL ACTIVITIES FOR CMB FACULTY section above):

- CMB Short Courses
- CMB/PIBS Recruiting and Admissions section
- CMB Student Advising
- CMB Program Committee
- Mentoring CMB student dissertation research

In addition, at the time each faculty member is reviewed, she/he provides an updated NIH Biosketch, including publications and grant support. Loss of funding should not lead to dismissal from CMB unless this is for a prolonged period of time. However, a CMB faculty member without long-term funding adequate to support a student and the student's research cannot accept new CMB graduate students into his/her lab.

CMB initiates the faculty review by asking the faculty member whether she/he wishes to apply for membership renewal. Faculty Review Committee members will review faculty by the above criteria and recommendations made to the Program Committee. Active faculty members who fulfill the criteria required for program membership will generally be renewed for 5 years. If the Faculty Review Committee determines that a faculty member no longer fits the criteria for continued membership in CMB, a recommendation will be made to the Program Committee that membership not be renewed. Re-application for admission to CMB is an option for any faculty member who would like to be re-considered for membership at a later date. The Faculty Review Committee and the Program Committee will evaluate the strengths and weaknesses of the actual review process on a regular basis, and make adjustments accordingly.

## APPENDIX A

### Resources for Students

#### Academic Resources

Center for Research on Learning and Teaching: <http://www.crlt.umich.edu/index.php>

#### Career Resources

[sciencecareers.sciencemag.org/](http://sciencecareers.sciencemag.org/)

[www.med.umich.edu/pibs/careeresource.htm](http://www.med.umich.edu/pibs/careeresource.htm)

[www.rackham.umich.edu/StudentInfo/listings/Career.html](http://www.rackham.umich.edu/StudentInfo/listings/Career.html)

#### Disability Resources

<http://www.umich.edu/Disability/>

[http://www.umich.edu/Disability/disability\\_aa\\_student.php](http://www.umich.edu/Disability/disability_aa_student.php)

#### Dissertation Resources

[www.rackham.umich.edu/dissertation\\_information/](http://www.rackham.umich.edu/dissertation_information/)

[www.rackham.umich.edu/OARD/](http://www.rackham.umich.edu/OARD/)

[www.gradtools.umich.edu](http://www.gradtools.umich.edu)

#### Diversity at Michigan

Association of Multicultural Scientists at U-M: <http://www.umich.edu/~amsweb/AMS/Home.html>

Students of Color of Rackham: <http://www.umich.edu/~scorweb/about.html>

#### Funding Resources

<http://www.med.umich.edu/pibs/prospective/fund/index.html>

[www.rackham.umich.edu/funding\\_resources/](http://www.rackham.umich.edu/funding_resources/)

[Grants2.nih.gov/grants/oer.htm](http://Grants2.nih.gov/grants/oer.htm)

[www.nsf.gov/index.jsp](http://www.nsf.gov/index.jsp)

[www.asee.org/resources/fellowships/ndseg/](http://www.asee.org/resources/fellowships/ndseg/)

[www.grantsnet.org](http://www.grantsnet.org)

#### Poster Printing

Groundworks: <http://www.dc.umich.edu/posterprinting/index.html>

CDB poster printing: <http://www.med.umich.edu/cdb/poster-printing.html>

FedEx Office (formerly Kinko's): <http://fedex.com/us/office/>

#### Research Resources

U-M Core Facilities: [https://www.umms.med.umich.edu/mcores/pub\\_list\\_all.do](https://www.umms.med.umich.edu/mcores/pub_list_all.do)

**Appendix B**

**REPRESENTATIVE ACADEMIC PROGRAMS**

**EXAMPLE 1. FOR A CMB STUDENT INTERESTED IN **CANCER BIOLOGY****

<u>First year (PIBS)</u>	<u>Second year (CMB)</u>
<p><u>Fall term</u>                      PIBS 503 – Research skills / Research responsibility and Ethics (1 cr)                      PIBS 600 – Research Rotation (variable cr)                      CMB 850 – CMB student seminar (optional, 1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)</p> <p>BCHM 550 – Macromolecular Structure &amp; Function (3 cr)                      HumGen 541 – Molecular genetics (3 cr)                      Or                      BCHM 550 – Macromolecular Structure &amp; Function (3 cr)                      CDB 530 – Cell Biol (3 cr)</p>	<p><u>Fall term</u>                      CMB 850 – Student seminar (1 cr)                      CMB 630 – Advanced topics in Molecular Biology (1 cr)                      CMB 990 - Precandidate dissertation research (variable cr)</p> <p>MI/Path 553 – Molecular Biology of Cancer (3 cr)                      CDB 530 – Cell Biology (3 cr)                      or                      MI/Path 553 – Molecular Biology of Cancer (3 cr)                      Physiol/BCHM 591 – Special Topics in Signal Transduction (2 cr)                      or                      Pharm 612 – Antimicrobial &amp; cancer pharmacol (2 cr)</p>
<p><u>Winter term</u>                      PIBS 600 – Research Rotation (variable cr)                      CMB 850 – CMB student seminar (optional, 1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)</p> <p>Path 581 – Tiss, Cell and Molec Basis of Disease (3 cr)                      Bioinf 525 – Foundations in Bioinformatics &amp; Systems Biology (3 cr)                      or                      Bioinf 551 – Proteome Informatics (3 cr)</p>	<p><u>Winter term</u>                      CMB 850 – Student seminar (1 cr)                      CMB 630 – Advanced topics in Molecular Biology (1 cr)                      CMB 990 - Precandidate dissertation research (variable cr)</p> <p>BCHM 640 – Post-transcriptional mechanisms (2 cr)                      CanBiol 554 – Cancer Pathogenesis &amp; Treatment (4 cr)                      or                      Physiol/HumGen 555 – Integrative Genomics (3 cr)</p>

Shaded areas denote PIBS and CMB courses

CMB 630 – Short Course is formally titled: Advanced topics in Molecular Biology

**EXAMPLE 2. FOR A CMB STUDENT INTERESTED IN STEM CELLS & DEVELOPMENTAL BIOLOGY**

First year (PIBS)	Second year (CMB)
<p><u>Fall term</u>                      PIBS 501/503 – Research skills / Research responsibility &amp; Ethics (1 cr)                      PIBS 600 – Research Rotation (variable cr)                      CMB 850 – CMB student seminar (optional, 1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)</p> <p>CDB 530 – Cell Biology (3 cr)                      BCHM 550 – Macromolecular Structure &amp; Function (3 cr)</p>	<p><u>Fall term</u>                      CMB 850 – Student seminar (1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)                      CMB 990 - Precandidate dissertation research (variable cr)</p> <p>HumGen 541 – Molecular Genetics (3 cr)                      CDB 680 – Organogenesis of complex tissues (3 cr)                      or                      MCDB 614 – Experimental Models in Molecular, Cellular &amp; Developmental Biology (3 cr)</p>
<p><u>Winter term</u>                      PIBS 600 – Research Rotation (variable cr)                      CMB 850 – CMB student seminar (optional, 1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)</p> <p>CDB 580 – Principles of Development (3 cr)                      Or                      CDB 550 – Histology (4 cr)</p> <p>BCHM 645 – Advanced Topics in Protein Trafficking (3 cr)</p>	<p><u>Winter term</u>                      CMB 850 – Student seminar (1 cr)                      CMB 630 – Advanced topics in Molecular Biology (1 cr)                      CMB 990 - Precandidate dissertation research (variable cr)</p> <p>Physiol/BCHM 576 – Signal transduction (1 cr)                      Bioinf 525 – Foundations in Bioinformatics &amp; Systems Biology (3 cr)</p>

Shaded areas denote PIBS and CMB courses

CMB 630 – Short Course is formally titled: Advanced topics in Molecular Biology

**EXAMPLE 3. FOR A CMB STUDENT INTERESTED IN GENETIC/EPIGENETIC MECHANISMS**

First year (PIBS)	Second year (CMB)
<p><u>Fall term</u>                      PIBS 503 – Research skills / Research responsibility and Ethics (1 cr)                      PIBS 600 – Research Rotation (variable cr)                      CMB 850 – CMB student seminar (optional, 1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)</p> <p>HumGen 541 – Molecular Genetics (3 cr)                      BCHM 550 – Macromolecular Structure &amp; Function (3 cr)                      or                      ChemBio 501 – Chemical Biology</p>	<p><u>Fall term</u>                      CMB 850 – Student seminar (1 cr)                      CMB 630 – Advanced topics in Molecular Biology (1 cr)                      CMB 990 - Precandidate dissertation research (variable cr)</p> <p>CDB 530 – Cell Biology (3 cr)                      Physiol/BCHM 591 – Special Topics in Signal Transduction (2 cr)</p>
<p><u>Winter term</u>                      PIBS 600 – Research Rotation (variable cr)                      CMB 850 – CMB student seminar (optional, 1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)</p> <p>BCHM 650 – Mechanisms of Eukaryotic Gene Expression (3 cr)                      Bioinf 527 – Introduction to Bioinformatics &amp; Computational Biol (4 cr)                      or                      Bioinf 545 – Data Analysis in Molecular Biology (3 cr)</p>	<p><u>Winter term</u>                      CMB 850 – Student seminar (1 cr)                      CMB 630 – CMB Short Course (1 cr)                      CMB 990 - Precandidate dissertation research (variable cr)</p> <p>BCHM 640 – Post-transcriptional gene regulation (2 cr)                      Physiol/ HumGen 555 – Integrative Genomics (3 cr)                      or                      Biophys 440 - Biophysics of Diseases (3 cr)</p>

Shaded areas denote PIBS and CMB courses

CMB 630 – Short Course is formally titled: Advanced topics in Molecular Biology

**EXAMPLE 4. FOR A CMB STUDENT INTERESTED IN TRANSLATIONAL RESEARCH**

<b>EXAMPLE 4. FOR A CMB STUDENT INTERESTED IN TRANSLATIONAL RESEARCH</b>	
<b>First year (PIBS)</b>	<b>Second year (CMB)</b>
<p><u>Fall term</u>                      PIBS 503 – Research skills / Research responsibility and Ethics (1 cr)                      PIBS 600 – Research Rotation (variable cr)                      CMB 850 – CMB student seminar (optional, 1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)</p> <p>CDB 530 – Cell Biology (3 cr)                      HumGen 541 – Molecular Genetics (3 cr)</p>	<p><u>Fall term</u>                      CMB 850 – Student seminar (1 cr)                      CMB 630 – CMB Short Course (1 cr)                      CMB 990 - Precandidate dissertation research (variable cr)</p> <p>BCHM 550 – Macromolecular Structure &amp; Function (3 cr)                      Physiol 510 – Systems &amp; Integrative Physiology (4 cr)                      or                      MI/Path 553 – Cancer Biology (3 cr)</p>
<p><u>Winter term</u>                      PIBS 600 – Research Rotation (variable cr)                      CMB 850 – CMB student seminar (optional, 1 cr)                      CMB 630 – CMB Short Course (optional, 1 cr)</p> <p>PIBS 507 – Introduction to Translational Research (3 cr)                      Physiol 520 – Computational Systems Biology in Physiology (3 cr)                      MI 619 – Pathogenic Evaluation of Animal Models of Human Disease (1 cr)</p>	<p><u>Winter term</u>                      CMB 850 – Student seminar (1 cr)                      CMB 630 – CMB Short Course (1 cr)                      CMB 990 - Precandidate dissertation research (variable cr)</p> <p>Physiol/HumGen 555 – Integrative Genomics (3 cr)                      or                      HumGen 542 – Molecular Genetic basis of human disease (3 cr)</p>

Shaded areas denote PIBS and CMB courses

CMB 630 – Short Course is formally titled: Advanced topics in Molecular Biology

