Program in Cell Biology

School of Medicine
Case Western Reserve University

http://www.cwru.edu/med/cellbiology
# Table of Contents:

A. Introduction ................................................................. 3  
B. Cell Biology Program ...................................................... 3  
C. Cell Biology Training Faculty .......................................... 4  
D. Program Requirements and Plan of Study ......................... 5  
E. Time Line of the Graduate Study .................................... 7  
   E1. Year One, first six months ......................................... 7  
   E2. Year One, the second half ......................................... 8  
   E3. Year Two, Qualifying Exam ....................................... 9  
   E4. Year Three, Thesis Proposal/Exam ............................... 10  
   E5. Year Four and Beyond .............................................. 13  
F. Graduation ................................................................. 14  
G. Student Activities ....................................................... 16  
H. Stipends and Tuition ................................................... 17  
I. Student Resources ....................................................... 18
A. Introduction

Cell Biology is a hypothesis-based discipline which - being more than the sum of its parts - integrates information from genetics, anatomy and biochemistry/molecular biology. Cell Biology emphasizes both basic science and disease-related studies, each of which has often enriched the other. Much of Cell Biology is concerned with topographic issues, the dynamics of macromolecular structure and localization, and the biogenesis of macromolecular structures and organelles.

By focusing on the cell as a functional unit, either as independent, single-celled organisms or as the building blocks of tissues, modern Cell Biology combines holistic biology with the reductionist disciplines of biochemistry and molecular biology. Cell biologists draw on all available technologies and disciplines to understand the molecular basis of the processes that cells carry out every day. Examples of these processes include interactions with and responses to their environment, and the regulation of cell growth and division. By studying cell structure and function in diverse organisms, cell biologists also contribute to our understanding of the history of life. Current evidence indicates that prokaryotic cells have been present on Earth for several billion years. The origin of eukaryotic cells remains a mystery, but it is generally agreed that the evolution of a cell with a compartmentalized, membrane-bounded nucleus was one of the major innovations that led to the diversity of multicellular organisms.

Many cellular processes can be analyzed by studying cells in laboratory culture. There is also growing emphasis on methods to study cells and subcellular events in the intact tissues of multicellular organisms. Within the broad technical repertoire of cell biologists, the analysis of cell structure by microscopy has a special place. Cells were first observed scientifically – and named - by Robert Hooke in 1664, using a microscope of his own design. To this day, microscopy has remained a central tool for understanding cells. Recent technological innovations now permit analysis of cells and their molecular components at nanometer resolution and in real-time.

Understanding how cells work is a satisfying goal in its own right, and contributes important practical advances in medicine and biotechnology. For example, the detailed understanding of how receptor tyrosine kinases work is leading to a new generation of anti-cancer drugs. Understanding processes such as cell adhesion or vesicular trafficking has repeatedly shed light on the causes of human genetic diseases and is also important for designing strategies to manage acquired disorders, and for tissue engineering. Thus, graduate training in Cell Biology is valuable for a career in many areas relevant to medicine, basic science, and biotechnology.

B. Cell Biology Program

The Cell Biology Program at Case/LRI offers students training opportunities as research science professionals through formal coursework, the conduct of original research in the laboratory of their selected mentor, and through informal interactions provided by seminars, journal clubs and laboratory meetings. The centerpiece of this training is the student’s research project that provides the opportunity for completion of a written thesis and preparation of paper(s) for publication in peer-reviewed journals. By completing the Cell Biology Program, students receive a comprehensive training in scientific excellence, research ethics, and oral and written communication skills, and will be cognizant of research frontiers in modern cell biology.

The inter-departmental Cell Biology Program includes faculty from Basic Science Departments of the School of Medicine, Clinical Departments at University Hospitals of Cleveland and from
the Lerner Research Institute of the Cleveland Clinic Foundation. The Program has a weekly seminar program/journal club for students, fellows and faculty. The Program has organized an international meeting (Membrane Traffic in Health and Disease, 1996), specialized lecture series (Cell Biology of the Fragile X Syndrome and other Trinucleotide Repeat Diseases (2000); Cell Biology of Huntington’s Disease, 2001) and a Symposium concerned with both the fundamentals of nucleocytoplasmic transport and examples of the importance of such transport (2004). Biannual Cell Biology retreats have been organized over the past several years.

C. Cell Biology Training Faculty

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D. Program Requirements and Plan of Study

It is the responsibility of the student to become familiar with the general rules and regulations of the University (available in the General Bulletin) as well as the specific rules that apply for the course of study in Cell Biology (this document).

The Graduate Program Advisor at Case or LRI oversees graduate training in the Cell Biology Program. The GPA will meet with each student at registration to sign relevant forms, discuss progress and provide advice on the formation of a Curriculum Advisory Committee (CAC) and course selection. The GPA also coordinates student activities and can serve as a student advocate should difficulties arise. Registration forms for all graduate students in Cell Biology must be signed by the Program Director.

Most students arrive July 1 and immediately begin a lab rotation. Because the summer session is not encumbered by coursework, often this rotation is the most robust laboratory experience. In the Fall, students enroll in the correlated Curriculum in Cell and Molecular Biology (CBIO 453/455) and pursue lab rotations. Doctoral students are required by the University to take 36 semester hours of graduate courses; this includes required courses, advanced electives and CLBY601 research.

Planning the Study Program

Graduate study assumes maturity on the part of the student in planning and reaching educational objectives. The students will work closely with the Graduate Program Advisor who will aid in the planning and attaining of curriculum goals. However, the effectiveness of the overall graduate program also lies with the individual student, the faculty advisor, and the thesis advisory committee (see below), which guide the student through the research and dissertation portions of the program. University regulations are intended to maintain uniform minimum standards of performance, to form a basis for planning programs of graduate study, and to provide efficient management and coordination of graduate programs.

When advancing to candidacy, doctoral students must submit a planned program of study in consultation with their advisor. After the faculty advisor, program director, and the CAC have approved the program of study, it must be submitted to the dean of graduate studies. Subsequent changes to the program of study are submitted according to the same procedure.

A program of study should include appropriate courses, together with work on the doctoral dissertation. Students entering with a bachelor's degree must complete a minimum of 36 credit hours of courses (which may include independent study/research, Course CLBY 601), and seminars. 24 of the credit hours must be graded courses. In addition, students must take a minimum of 18 credit hours of dissertation research (Course CLBY 701). For students entering with an approved master's degree, completion of not fewer than 18 total credit hours is required.

Curriculum Modifications for MSTP students

MSTP students must satisfy all of the requirements indicated above except:

1. They are excused from CBIO 453 and CBIO 455 and PATH 510 due to overlap with the medical curriculum. They are excused from BSTP 400 due to overlap with the MSTP 400.
2. They can apply up to 18 graded credits from IBIS graduate courses taken in the medical curriculum to the PhD requirements. This gives credit for one track elective.

3. They must take the Cell Biology core course (CLBY422) and a track elective in the first two years of the MSTP (prior to entering the PhD phase).

4. When MSTP students enter the PhD phase they should be at a stage equivalent to second year BSTP students; subsequent timing of events and expectations for progress should be adjusted accordingly.

5. Prior to the PhD phase, MSTP students are encouraged to attend the seminar series relevant to their research interests and potential track in the Graduate Program of their Department.

The doctoral residency requirement is intended to insure a period of intensive academic interaction with faculty, peers, and of sustained independent research. The formal fulfillment of residency requires continuous registration in at least six consecutive academic terms (fall, spring and/or summer) from matriculation to a period not exceeding five years after the first credited hour(s) of dissertation research (CLBY 701).

A minimum cumulative quality-point average of 3.00 in all courses taken for credit as a graduate student at CWRU (excluding those with the grade “S” or “P”) is required for award of the doctoral degree.

**Cell Biology Ph.D. Program minimum requirements:**
- C3MB core course
- Cell Biology Core Course CLBY422
- Ethical issues/Professionalism Course
- Cell Biology Colloquia
- Elective courses
- CLBY 701 thesis research

**A typical course of Cell Biology Ph. D. Study**

**YEAR 1**
- July: BTSP 400 Research rotation
- September: CBIO453 Cell Biology I, CBIO 455 Molecular Biology I, BSTP 400 Research Rotations
- January: CLBY 111 Ethics, Professionalism course, CLBY 512 Cell Biology colloquia, CLBY 601 Cell Biology special problems/electives
- Make decision for thesis research laboratory
- By June: Join ASCB

**YEAR 2**
- July: CLBY 601 Special Problems
- CLBY 222 Cell Biology colloquia
- CLBY 601 special problems/ elective
- Sept-Dec: CLBY 422 Topics in Cell Biology (required Program course)
January

CLBY 512 Cell Biology colloquia
CLBY 601 special problems/electives

Between January and March: Form committee for qualifying exam and identify topic

By June

Take qualifying exam

By June

CLBY 601 Finish elective credits (if possible)

YEAR 3

July

Form thesis advisory committee

Aug-October

Prepare thesis proposal

September

CLBY 512 Cell Biology colloquia
CLBY 601 completion if needed
CLBY 701 Ph. D. Dissertation

By December

Have first thesis advisory committee meeting

January

CLBY 512 Cell Biology colloquia
CLBY 701 Ph. D. Dissertation

YEAR 4

Meet with thesis advisory committee every 6 months in year 4

July

CLBY 222 Cell Biology colloquia
CLBY 701 Ph. D. Dissertation

By July

Second thesis advisory committee meeting

December

ASCB meeting attendance

January

CLBY 512 Cell Biology colloquia
CLBY 701 Ph. D. Dissertation

YEAR 5.

Meet with thesis advisory committee every 6 months in year 5

July

CLBY 701 Ph. D. Dissertation

(December

ASCB meeting)

January

Thesis defense

Potential Elective courses:

CLBY 416. Fundamental Immunology
CLBY 417. Cytokines: Function, Structure
CLBY 427. Developmental Neurobiology
CLBY 467. Advanced Molecular Immunology
CLBY 472. Membrane Physiology
CLBY 473. Protein Biosynthesis
CLBY 474. RNA and DNA Biosynthesis
CLBY 487. Cell Biology of the Nucleus
CLBY 488. Yeast Genetics/Cell Biology
CLBY 501. Genetic Control of Development
CLBY 505. Neurochemistry and Neuropharmacology
CLBY 515. Endocrine Pharmacology
CLBY 518. Signaling via Cell Adhesion
CLBY 519. Structure and Function of RNA
CLBY 525. Macromolecular Transport in health and Disease
CLBY 555. Emerging Concepts in Cell Regulation
CLBY 601. Special Problems
CLBY 701. Dissertation Ph.D.
E. Time Line of the Graduate Study

E1. Year One, first six months:
During the first six months of their academic program, students complete research rotations, take the core C3MB course and select a thesis mentor.

Rotations: Rotations provide exposure to a variety of research problems and laboratory techniques. All students enrolled in the Biomedical Sciences Training Program (BSTP) must complete a minimum of three rotations of 4-6 weeks duration by December 15 of their first year. By arriving on July 1, a student may have sufficient time for more than three rotations.

During the summer and when classes are not in session, students are expected to work in the lab at least 40 hours per week. Once classes begin, the time spent in activities associated with the rotation may be reduced to 20-25 hours per week. In addition to laboratory work, students participate in other research-related activities such as lab meetings, journal clubs, and departmental seminars to get a better idea of what it would be like to be a member of the Program.

At the conclusion of each rotation, students prepare a rotation report and submit it to the rotation advisor for review. Typically, the report should be 2-3 pages double-spaced (not including literature citations), but it may be longer if the student has data figures to present. The rotation supervisor fills out a Rotation Evaluation Form. The student and mentor conduct an "exit interview" to discuss the rotation as a whole and go over the evaluation and report. This interview is intended to be constructive and to give useful feedback to the student. It is expected that the research advisor will be honest and indicate the degree to which s/he is interested in having the student pursue dissertation research in her/his lab. The student may also want to indicate his/her degree of interest to the PI during the exit interview.

Courses: During the fall semester, students must complete the Core Curriculum in Cell and Molecular Biology (CBIO 453/455), an integrated course which provides formal instruction in modern cell and molecular biology. This course covers the biology of eukaryotic organisms including basic genetics, macromolecular biosynthesis, regulation of gene expression, cell structure/function, growth and signaling. The course content is designed to provide a foundation upon which students’ graduate research will build.

Students must register for 9 credit hours during the fall semester, which is the minimum number of credit hours required for full-time student status. Typically, this will consist of the Core Curriculum (CBIO 453 and 455; 6 hours) and 3 hours of research rotation (BSTP 400).

Selection of a mentor: The choice of mentor is of paramount importance for graduate study and career development. Thus, it is important to weigh this decision carefully. Although choosing a thesis advisor whose research interests match one’s own is an important consideration, other factors should also be taken into account. In addition to evaluating the environment in various labs, students should consider the type and quality of available research projects, the influence of postdocs and other students in the lab, the level of the advisor’s involvement in the day-to-day life of the laboratory, and the character of the advisor’s relationship with students. However, it is important to emphasize that there is no absolute scale for rating such intangible qualities of the research lab; rather, they must be considered in light of
the distinctive features of an individual student's personality and approach to experimentation and learning.

In rare cases, a student may exhaust his or her options without being assigned to a lab. Such cases are handled on an *ad hoc* basis. If necessary, the student may be allowed more time to consider additional laboratories. However, the student must be accepted into a laboratory by March 15. Any faculty member who agrees to accept a rotation student after January 1st of the first year must assure continued financial support should the student decide to work in that laboratory.

**E2. Year One, the second half:**

In the latter half of first year a Cell Biology student initiates a research project, continues with the course work and forms a Curriculum Advisory Committee (CAC).

**Courses:** Once a student has chosen a mentor and joined the Cell Biology Program, the student takes one credit hour of the Cell Biology colloquia series at Case or at the LRI - initiates a research project (CLBY601) and forms a Curriculum Advisory Committee (CAC) in the Spring Semester.

While the Program's major emphasis is to provide a stimulating atmosphere conducive to carrying out high quality, independent research, it is recognized that a certain amount of formal instruction is necessary and desirable for Ph.D. students. To address this need, a flexible program of coursework is outlined below. It is expected that the student, in consultation with her/his thesis mentor and advisory committee, will design a program compatible with her/his research goals. In general, students should enroll in two advanced courses during the spring semester of their first year. Ph.D. students are required by the University to take 36 semester hours of graduate coursework; this total includes required courses, advanced electives and CLBY 601 (pre-thesis research). At least 24 hours must be graded coursework (not research). For the typical student in the Cell Biology Program, the University course requirement, as well as the program requirement, will be satisfied by 8 hours of Core Curriculum (C3MB) in the first semester, 3 hrs of CLBY 422 (Topics in Cell Biology) in year 2, 13 hours of advanced coursework in subsequent years, and 12 hours of CLBY 601. Grading in CLBY 601 is on a P/NP basis (University rule, see General Bulletin), and because no more than 12 hours graded P may count towards the University course requirement (another University rule), it follows that 16 hours of advanced coursework must receive traditional letter grades. Students who elect to take an advanced course graded P/NP can report these hours in place of comparable CLBY 601 hours for satisfying the University requirement, if they so desire, but will still need to accumulate 18 credit hours of traditionally-graded advanced coursework prior to graduation. For Ph.D. students, credit can be counted towards the degree only for advanced courses at the 400 level or higher. Although no specific advanced courses are absolutely required, some appropriate course have been listed in section 3. Most of these are cross-listed in several departments.

**CAC:** The CAC consists of at least 4 faculty of Case or the LRI, at least 3 must be training faculty of the Cell Biology Program and at least one must be outside the Program. One is chosen by the student, two members are appointed by the Program Directors, and the student’s mentor becomes the fourth member, although he/she is NOT an active participant and evaluator of the Qualifying Exam. If the mentor’s lab is located at Case School of Medicine, at least one member of CAC will be from the LRI and *vice versa*. The function of CAC is to guide the student in curriculum selection and to act as an examination committee for the Qualifying Exam. With the possibility of adding additional members it later become the Thesis Advisory Committee (TAC).
E3. Year Two Qualifying Exam: 
During the second year, students prepare for the Qualifying Exam, and take CLBY 422 as well as advanced elective courses.

Courses: The summer following the first year of graduate study provides students with their first opportunity to devote their full energies to research in the Ph.D. thesis lab. This time should be spent continuing to develop the thesis project not only through bench work but also through critical reading of the literature and discussions with their mentor and other members of the research group.

Students will continue to accumulate credit towards the Ph.D. degree during the Fall semester of the second year. It is suggested that students enroll in at least one 3 credit graduate-level course during the fall semester of year 2 and in CLB 422 (Topics in Cell Biology) during the spring. Students will continue to participate in all departmental seminars, for which they will receive 1 credit hour by registering for CLBY 435. Students will spend the remainder of their time on thesis research and register for the appropriate number of hours of CLBY 601 to make up 9 credit hours total.

Qualifying Exam: The requirements for the Qualifying Exam are satisfactory completion of the Cell Biology courses which include CBIO 453/455, and at least one credit hour of the Cell Biology colloquia series (CLBY222). For most students, this will occur by the end of the Spring semester of their first year. It is expected that Qualifying Exam will be completed before the end of the second year of graduate school.

The Qualifying Exam: Students who have performed satisfactorily in their course work prepare for their Qualifying Exam. This process takes place throughout the spring. In consultation with the mentor and other members of the CAC, the student develops a set of specific aims that will constitute an original research plan which is obviously distinct from the research which the student intends to pursue for his/her thesis. The student submits an NIH-style research proposal to the thesis committee. This constitutes the written portion of Qualifying Exam. The student then defends that proposal to the CAC, and this constitutes the oral portion of Qualifying Exam. The oral defense must be completed before the end of the second year. The student's performance is discussed and a written evaluation is compiled by the chair of the thesis committee.

Qualifying Exam Proposals and Recommended Format
Proposals should not exceed 10 single-spaced pages in length (excluding references) and should follow the NIH proposal (PHS 398, available on the internet) format including the following sections.
1. Specific Aims - introductory paragraph clearly summarizing the project and long-term goals. Clearly stated hypotheses and a list of the specific goals to be accomplished with brief rationales and approaches (generally one page)
2. Background and Significance - background of proposed research including work performed previously by others (generally 2-3 pages)
3. Qualifying Results – optional
4. Experimental Design and Methods - detailed description of proposed studies. Within this section, it is important to clearly state the rationale for each experiment and map out the overall general design. Present enough information to convince the committee that you know how to do these experiments. Detailed protocols of rather routine assays (Northerns, Westerns, etc.) are not necessary. More methodology may be required for specialized approaches. Finally, for each
major experimental approach, you should address potential outcomes, interpretations, discuss pitfalls, and alternative strategies.

5. References - Include titles and follow a standard citation technique which includes titles and all authors.

*The student-mentor interaction in this process*

The student will submit an NIH-style written thesis proposal to their thesis committee 14 days prior to the exam meeting. The written proposal will be developed by the student in close consultation with the mentor. This generally involves a series of discussions between the student and mentor where details of the specific aims page are formulated. The general mechanics of effective grant writing and grant formulation are also discussed early and emphasized throughout the process. It is appropriate to use the mentor's own grant applications as useful models. However, the written proposal should be the student's own. The mentor should not contribute text to the written document. For example, the mentor and student might discuss general methods, approaches, and reagents that could be used or developed to accomplish these aims. However, the student should provide the overall plan of attack, the written details, rationales, appropriate controls, potential outcomes and interpretations. General areas of weakness or gaps might be identified by the mentor, but specific approaches to fill these gaps should be the student's responsibility. The ultimate goals of this process are:

a. For the student and mentor to get together early in the student's laboratory tenure to generally define a research plan that has a strong potential to lead to a Ph.D. dissertation

b. For the student and mentor to develop open communication about the research plan and establish long-term research goals

c. For the student to learn effective grant writing techniques and research planning from the mentor and others

d. For the student and mentor to assemble a thesis committee early in the student's laboratory years

e. For the student to plan and defend the research plan in an oral examination format with the thesis committee

With these goals in mind and with the emphasis placed on a student-driven written proposal and oral examination, it is ultimately the responsibility of the mentor to decide how best to accomplish these goals and to provide a valuable training experience to the student.

Following the Qualifying Examination, the mentor and student are encouraged to meet and discuss the strengths and weaknesses of the examination and the final written proposal. The intent of this meeting is emphasize the strong points and identify areas where further development would be useful.

**E4. Year Three – Written Thesis Proposal**

During this time students finish the required credit hours and present their thesis proposal to the TAC.

**Thesis Proposal/Exam:** The thesis proposal should follow the format described for the Qualifying Exam. The student should present this proposal during his/her fifth semester to his/her TAC. The chair of this examination committee is usually the chair of the TAC. Upon completion of the exam, the thesis proposal becomes a work-in-progress. The examination committee then takes on the role of the thesis advisory committee. The mentor cannot be the chair of the TAC.
Courses: At the end of fall semester, Year 2, students will have completed the following: CBIO 453/455 C3MB (Cell and Molecular Biology), 3 research rotations, CLBY 422 (Topics in Cell Biology) Cell Biology Colloquia, one or two elective courses, and the Qualifying Exam. Successful completion places the student in good standing for advancement to candidacy. Unsuccessful performance of any one of these items constitutes probationary status with appropriate remedial measures defined on an individual basis. More than one unsuccessful performance may lead to dismissal from the program.

A decision concerning advancement to candidacy will occur following the Qualifying Exam. The following criteria will be used to justify advancement.
1. Successful completion of the Qualifying Exam.
2. Completion of courses.
3. An overall B average with no more than 1 C in all courses.
4. Initial performance in the laboratory of choice.

The Dean of Graduate Studies and Research must be notified in writing of the decision concerning a student's advancement to candidacy within the specified limits, and a copy of the notification must be sent to the student concerned.

CLBY 601 and CLBY 701
Upon written notification to the Dean of Graduate Studies that a faculty member has been selected as a doctoral student's principal research advisor, the student will be acknowledged by the Dean as eligible to register for one to six credit hours of "Dissertation Research" (course CLBY 601) each semester. Students must continuously register for 601 until he/she passes the Qualifying Exam. Upon successful completion of the Qualifying Exam, the student registers for CLBY 701 until the graduation.

Pre-candidacy 601 hour(s) can only be taken concurrent with course work. A student is permitted to register for a maximum of nine (9) credit hours (full-time status) of 701 each semester only after advancement to candidacy.

Advancement to Candidacy Form: Once Ph.D. students have successfully passed all courses and the Thesis Exam, they can be formally advanced to candidacy. Notification needs to be sent to the Office of Graduate Studies via this form when advancement occurs.

Planned Program of Study Form: Submit after advancing to candidacy.

Predoctoral Standing Form: Students who have already completed or will complete all their required course work in the next semester, and have not been advanced to candidacy, may begin 701 registration. With this special status, students are limited to registering for up to 6 hours of 701 research credits. It is presumed that students will take their exams and be advanced to candidacy during the semester in which predoctoral standing is granted.

Notification for Scheduling the Final Oral Exam for the Ph.D.: Submit a minimum of 3 weeks prior to defense date

Thesis Committee Meetings
The TAC will meet every 6 months to monitor student progress, advise on alternative
approaches, or approve any modifications in specific aims of the proposal. These meetings are
a prerequisite for student registration each semester. Meetings can be held more frequently if
requested by the student or thesis committee. The graduate program administrator will alert
students and committee members of the timing for each meeting. The graduate program
administrator will also arrange the meetings for the student. Students will prepare a written
summary of the research that has been accomplished during the 6 month period between
committee meetings. These should be distributed to all committee members at least one week
prior to the meeting. The mentor or thesis committee chair will advise the student on the format
and length of the written summaries. At a minimum, these summaries should include:

1) specific research objectives for the 6 month period, 2) research accomplished toward those
objectives, and 3) future research objectives for the next 6 month period. Written summaries
and evaluations of the meeting are prepared by the thesis committee chair. These are
forwarded to the student, committee members, the graduate program director, and the graduate
program administrator. The student also prepares a brief written summary of the meeting. This
summary should include the revised 6 month research objectives that were agreed upon at the
committee meeting. The student-prepared summaries should be distributed to all of the thesis
committee members and to the graduate program administrator.

The mentor and student are strongly encouraged to meet after each committee meeting to
discuss their impressions of the meeting.

The research advisor is expected to provide mentorship in research conception, methods,
performance and ethics, as well as focus on development of the student's professional
communication skills, building professional contacts in the field, and fostering the professional
behavior standard of the field and research in general. The research advisor also assists with
the selection of three other faculty to serve as the required additional members of the
dissertation advisory committee.

Throughout the development and completion of the dissertation, these members are expected
to provide constructive criticism and helpful ideas generated by the research problem from the
viewpoint of their particular expertise. Each member will make an assessment of the originality
of the dissertation, its value, the contribution it makes, and the clarity with which concepts are
communicated, especially to a person outside the field.

**E5. Year Four and Beyond**

During the following year, the student completes the requirement for Thesis Defense. The
award of the Ph.D. degree depends on the completion of an original research project and the
public defense of that project. The Cell Biology Program has the additional requirement that a
minimum of one first author manuscript must have been accepted for publication in a highly
regarded journal and another manuscript must have been submitted (this could be a middle
author paper) before the final defense can be scheduled. This requirement provides further
validation of the originality and importance of the research that comprises the dissertation, since
the research has been reviewed by multiple outside reviewers that are experts in the chosen
field. It should be noted that this is a minimum requirement and it is fully expected that a
complete dissertation will likely result in several published manuscripts. Indeed, it is unusual for
students with a single publication to succeed in entering highly competitive laboratories for post-
doctoral study.

The final thesis committee consists of the original thesis progress committee and one new
member added specifically for review of the thesis and defense. This may be any member of the School of Medicine faculty or a respected faculty outside of Case. This member is chosen by the mentor and the student.

Each member makes an assessment of the originality of the work, its value to the field in general, and the significance of the contribution. Content must conform to regulations concerning format, quality, and time of submission as established by the dean of graduate studies and research. Detailed instructions can be obtained from the Office of Graduate Studies.

The defense must be scheduled with the Office of Graduate Studies no later than two weeks before the date of the examination. The candidate must provide to each member of the committee a copy of the completed dissertation at least 10 days before the examination so that the committee members may have an opportunity to read and discuss it in advance. Scheduled defenses are made known through on-campus publications and any member of the university may be present at that portion of the examination pre-designated by the chairperson of the examining committee.

Two copies of each completed and accepted dissertation will be deposited in a library of the University by the School of Graduate Studies. The University assumes the cost of binding these 2 copies of the dissertation. One copy of the completed and accepted dissertation will be deposited in the library of the Pharmacology Department. The Department will assume the cost of binding for this and will also assume the cost of binding for one copy for the student. The expense of additional bound copies will be assumed by the student. In addition, the student must guarantee the reproduction of the dissertation through University Microfilms, Ann Arbor, Michigan, before certification for the doctorate. This includes the completion and submission of the annual “Survey of Earned Doctorates Awarded in the United States”.

Dissertations are made public immediately upon acceptance, in which, they should not contain proprietary or classified material. When the research relates to proprietary material, the student and advisor are responsible for making qualifying disclosures to the sponsor sufficiently in advance to permit timely release of the dissertation.

**F. Graduation**

A candidate for a degree awarded by the School of Graduate Studies must make an application for the degree to the Office of Graduate Studies by the deadline established for that semester, which is approximately two months before the commencement date at which the degree is expected to be awarded. The candidate must meet all the deadlines for completion of degree requirements set forth in the calendar. All candidates must be registered and in good standing during the semester in which the degree is awarded. Full payment of tuition, fees and fines is a prerequisite to the award of a degree.

**Delayed Graduation**

A doctoral or master’s thesis applicant who meets all deadlines for commencement in one semester except for the deadline for submission to the Office of Graduate Studies of approved copies of the thesis or dissertation may request use of the “grace” period in order to graduate in the next commencement. Any student utilizing the delayed graduation option must notify the Office of Graduate Studies in writing of the intention to do so. Permission to use the grace period will be granted only once. Such a student will be permitted a one month period from the date of commencement for which application has been made for the purpose of making revisions to the defended thesis or dissertation in accordance with the recommendations of the
defense committee, in order to submit the required approved copies to the Office of Graduate Studies. A student who meets the delayed graduation deadline will be awarded the degree in the next commencement without the need to be registered or to pay a special fee. If a student fails to meet this deadline, she or he will be required to register for the appropriate thesis or dissertation credit hours in the next semester and to reapply that semester as a candidate for graduation. Upon written request to the Office of Graduate Studies, a master’s non-thesis (Plan B) applicant may use the grace period only relative to the scheduling of the required Comprehensive Examination or Completion and Submission of the final project.

M.S. degree requirements
The Cell Biology Program primarily accepts students whose goal is to obtain the Ph.D. degree. However, students decide to leave the program after having taken a substantial number of courses and/or having accomplished a reasonable amount of quality research. Such students usually desire to obtain a Master’s degree as certification of their accomplishments at the graduate level. The Program does not generally accept students who seek the M.S. degree directly.

Course work degree for students entering as Ph.D. candidates (Plan B):
This program is aimed at students who have taken most or all of the courses required for the Ph.D. but have not accomplished sufficient research to write a Ph.D. or Master’s thesis. Passing the qualifying exam required for admittance to candidacy in the Ph.D. program in Cell Biology satisfied the requirements for a Comprehensive Exam for the M.S. degree. A total of 27 credit hours is required.

Research degree for students entering as Ph.D. candidates (Plan A):
This program is aimed at students who have taken most or all of the courses required for the Ph.D. and have also made sufficient progress to write an acceptable Master’s thesis. Passing the qualifying exam required for admittance to candidacy in the Ph.D. Program in Cell Biology satisfies the requirement for a Comprehensive Exam for the degree. In addition to the course requirement candidates for this degree are required to submit an acceptable written thesis based on their original research. The acceptability of the thesis will be determined by an oral examination administered by the student’s TAC. A total of 27 credit hours is required.

A. Required courses:
1. CBIO 453, 455 (8 hours)
2. CLBY 222
3. CLBY 422
4. CLBY 601
5. CLBY 701

B. Selected other courses: To accumulate the required total of 27 credit hours of course work, the student may choose from any of the courses listed above. Alternatives to these courses may be taken with the permission of the student’s advisory committee.

G. Student Activities
Graduate students are expected to initiate and participate in a variety of activities that will promote their professional growth. Some of the required activities are listed below:

Cell Biology Colloquia:
Journal clubs and seminars offer an opportunity to learn about broad areas of Cell Biology, and form an important part of graduate training. The students and faculty are expected to attend the
weekly Journal Club at Case or at the LRI. In addition, they are expected to attend their respective weekly Departmental seminars. Students are strongly encouraged to actively participate by asking questions at seminars and journal clubs and by taking opportunities to have lunch with external speakers.

To gain oral presentation skills, students should make formal presentations to the Cell Biology community at least once a year, after practice with their advisors. Students in the first year may elect to present a current research article from a prominent journal; however, in following years they should present their own research. The Faculty offers constructive criticism to the student directly following the presentation.

**Weekly Seminar Series in BSTP Programs and the School of Medicine:**
Cell Biology students are strongly encouraged to attend seminar series offered by the other basic science departments in the School of Medicine and at the LRI. Students are also encouraged to participate in journal clubs sponsored by other BSTP programs.

**Frontiers in the Biological Sciences Lecture Series:**
This long-standing lecture series brings at least eight distinguished scientists to the medical school campus each year. One is selected by the Program.

**Meeting outside speakers for lunch.**
Students and postdoctoral fellows are encouraged to meet with visiting speakers at lunch before the Thursday seminar. This is a good opportunity to practice talking about science in a concise, interesting way. Further, it offers a means to get to know the speaker, his/her institution and to discuss scientific strategies or collaborations. Discussion lunches are also held after the Friday external speaker seminars at LRI, Dept. of Cell Biology.

**Graduate Students Symposium:**
The graduate students in the biomedical sciences organize a symposium once a year that includes student posters, student talks and a keynote speaker invited by students.

**Cell Biology Retreat:**
All members of the Program are expected to attend to discuss research and define program goals at the Cell Biology Program retreats.

**Attending the American Society For Cell Biology (ASCB) meetings:**
Students are encouraged to present their work at national meeting once a year. The American Society for Cell Biology is the world’s largest professional society for Cell Biologists. The Program will cover the cost of “first-time” ASCB membership and students are expected to attend at least one ASCB meeting as a part of the curriculum requirement.

**H. Stipends and Tuition**
All registered Cell Biology students matriculating on a full-time basis are eligible to receive tuition and stipend support. The stipend level for the present academic year is $23,000. Stipend levels, which are reviewed annually, are based on a support year of 12 months. Students are funded by NIH institutional training grants, NIH individual research service awards, federal and privately funded research grants and university resources.

Tuition rates are set annually by the CWRU Board of Trustees. Tuition for Cell Biology graduate students is funded by NIH institutional training grants or university resources.
The Tax Reform Act of 1986, Public Law 99-514, impacts on the tax liability of all individuals supported by NIH programs. Prior to 1986, degree candidates were able to exclude all monies received under an NIH award from their reported income. Currently, only tuition, fees, books, supplies and equipment required for graduate study may be excluded. Neither CWRU nor the Cell Biology Program may advise students about their tax liability. Students can obtain information and tax forms and publications at local libraries and post offices. Additional tax concerns include:
Individuals must take the initiative to identify themselves to their residential community to trigger the Regional Income Tax Authority’s awareness of their existence. If students are on a training grant, they should look into the tax implications of that income and consider making quarterly tax payments. See link: http://www.irs.gov/individuals/students/index.html

Please contact the Cell Biology Director or Coordinator for any other financial issues regarding tuition and stipends.

*Leave of absence from graduate study*
Occasionally a student finds it necessary to interrupt his or her studies before completion of the graduate program. Under such circumstances the student must request, in writing, a leave of absence for a period not to exceed one calendar year. This request, which requires endorsement by the student’s advisor and the department chairperson, must be submitted to the dean of graduate studies.

During a leave of absence the student must not avail him or herself of aid from faculty members or use of the facilities of the University. A leave of absence does not extend the maximum time permitted for the completion of degree requirements. At the expiration of the leave the student must resume registration unless formally granted an extension. A student returning from an official leave must first report to the office of graduate studies admission for clearance to register. A student who fails to obtain a leave of absence, or who fails to register following an official leave, must petition the dean of graduate studies for reinstatement in order to resume work as a student in good standing.

A doctoral student who is granted a maternity or paternity leave of absence related to infant care will receive an extension of the five year time limit from advancement to candidacy to completion of the doctorate. The length of the extension will correspond to the length of the leave.

*Medical Insurance*
The University requires that all students have medical insurance. No exceptions are allowed. Students with private insurance must sign and file a waiver of coverage with the University Health Service. If a waiver is not submitted, or if it is submitted past the assigned deadline for the semester, the student will be billed personally for payment of insurance fees and late charges.

In addition to basic major medical coverage, registered students are also eligible to use the University Health Service Clinic for routine medical services. During the summer semester, if you are covered by the student insurance and register for at least 1 credit hour, there will be no fee for health service. If, however, you do not register for at least 1 credit hour, and/or are not covered by the student insurance, you will be charged a one-time fee of $50 at your first appointment. If you never need service, you never need to pay the fee. If you need service multiple times, the initial $50 fee will cover all visits, etc. For more information, check the Health
Students' right to know
The Student's Right to Know and Campus Security Act requires that universities throughout the country produce statistics on the retention and graduation rates for their students, as well as

I. Student Resources
University Counseling Services
Counseling Service: 368-5872 - 201 Sears Hall
Mental Health Service: 368-2510 - University Health Service, 2nd floor

University Counseling Services (UCS) provides individual and group counseling, learning disability assessment, psychological testing and consultation to all undergraduate, graduate, and professional school students and their spouses or partners. In general, these services are offered on a short-term basis (usually 12 or fewer sessions) to help students make adjustments in their personal, social, and educational areas of life.

There are two locations where appointments can be made: the Counseling Service in 201 Sears Hall (368-5872) or the Mental Health Service at the University Health Service (368-2510). Both services are staffed with professional social workers, counselors, psychologists, psychiatrists, and substance abuse intervention and prevention specialists who are experienced in helping students with their concerns. In addition, the staff understands the need to maintain confidentiality. Therefore, the counselors at the UCS will not disclose information to any other party, e.g., faculty, parents, future employers; the release of information without the student's written consent would occur only in cases of emergency-these are extremely rare situations. Free workshops and seminars are also offered each semester on topics including test anxiety management, stress reduction, couples enrichment, overcoming shyness, and eating disorders. Also, the annual Sex, Drugs, and Rock n' Roll Conference is a unique presentation of this office.

Educational Support Services: 368-5230 - 110 Yost Hall
The Office of Educational Support Services (ESS) assists students in all phases of their academic development. Through advising, tutoring, group programs, and individual consultation, the ESS staff serves all CWRU students by providing opportunities for academic assessment and self-improvement. ESS also coordinates programs addressing the academic and adjustment needs of specific student populations: participants in CWRU's Minority Scholars Program (MSP), commuting students, and nontraditional students.
Housing and Residence Life: 368-3780 - Room 4, Yost Hall

Office of Student Affairs; 368-2020 - 110 Adelbert Hall
The University Office of Student Affairs provides leadership in the development of services and programs that supplement the classroom experiences of university students and enrich student life. The staff of the Office of Student Affairs attempts to promote an environment which provides positive, developmental experiences for all students. Additionally, the office serves as an ombudsman, focusing attention on the rights and responsibilities of students within the university community. The Office of Student Affairs is a central source of information about university policies and procedures that affect student life and co-curricular programs and services. Students should feel free to contact the Office of Student Affairs for resolution of specific problems and for referral to other university offices and campus agencies.

Students' right to know
The Student's Right to Know and Campus Security Act requires that universities throughout the country produce statistics on the retention and graduation rates for their students, as well as

Services web site at www.cwru.edu\stuaff\UHS\uhs.html. A proof of insurance card is available at Health Services and is highly recommended.
crime statistics, on their campuses. This data is available in the Office of the Provost in Adelbert Hall and in the various undergraduate, graduate and professional schools’ admissions office.

**Policy on sexual harassment**

It is the policy of Case Western Reserve University to provide a positive, discrimination-free educational and working environment. Sexual harassment is unacceptable conduct which will not be tolerated. All members of the University community share responsibility for avoiding, discouraging, and reporting any form of sexual harassment.

Members of the University community found in violation of this policy may be disciplined, up to and including being discharged for cause or being expelled from the University. Retaliation against persons raising concerns about sexual harassment is prohibited and will constitute separate grounds for disciplinary action, up to and including discharge or expulsion from the University.

The University has passed and disseminated to all parties on this campus—students, faculty and staff—a detailed statement titled Policies and Procedures Regarding Sexual Harassment and Sexual Assault. Copies are available in the Provost's Office, all the deans' offices and at many of the University offices throughout the campus. Consultation and advice are available in the offices of the Provost, Affirmative Action and Student Affairs. See the section, "Student Affairs," for policies and procedures regarding sexual assault. This policy and the accompanying procedures shall serve as the only internal University forum of resolution and appeal of sexual harassment complaints.

**PHONE NUMBERS, ETC.**

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**BIOMEDICAL SCIENCES TRAINING PROGRAM (BSTP)**

Coordinator: Debbie Noureddine 368-3347, Room WG46  
drn2@case.edu

**WEBSITES**

BSTP  
http://www.cwru.edu/med/BSTP/  
Case home page  
http://www.cwru.edu/  
Case Directory  
http://cnswww.cns.cwru.edu/phone/phonebook/local/  
Case Registrar  
http://www.cwru.edu/provost/registrar/registrar.html  
Case academic regulations for doctoral degrees
COMPUTING RESOURCES
Getting connected
This is the page that most of you will need. In this section, instructions and assistance on connecting and setting up your computer to the Case network are provided. Whether it is PPP dial-in or on-campus connection, how to setup email, where to get network drivers, or software downloads (email, Netscape, ftp)... It's all here!
http://help.cwru.edu/tech_support.html
Free “useful” downloads
The CWRUnet Software Library gives students free use of many of the latest software packages on their own computers, provided they have network access. Students may also use the software in the library from campus computer labs.
http://www.cwru.edu/net/softlib/softlib.html
Software packages include:
Microsoft Windows XP Professional
Microsoft Office
Pagemaker 7.0
Photoshop 5.5 & 6.0
Illustrator 7.0
SPSS
Borland C++, plus many other useful programs!
E-journals
Almost every journal provides quick and easy access to full-text versions of articles. CWRU libraries has established a listing of all e-journals with links:
http://www.cwru.edu/chsl/ejournal.htm (keep this page open while using PubMed)
Case has online subscriptions to most of the journals on the above webpage. However, performing a literature search using a computer with a CWRU IP address doesn’t guarantee that the journal website will recognize your computer as a paid subscriber. You will often need to go through the above link to access the online full-text versions of articles.