

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Overview

To complete the requirements for the Ph.D. degree in the Cell and Developmental Biology (CDB) graduate program, students must successfully complete required and elective courses, attend CDB departmental seminars, pass a qualifying examination, conduct independent research that results in publishable results, and write and defend a dissertation. The program requires the completion of at least 135 term-hours of course credit, of which 100 hours must be in either conjoint courses, departmental courses, or comparable courses offered by other graduate programs at OHSU. Generally, students are expected to enroll in 12-16 credit hours per quarter until the completion of their Ph.D. (including summer quarters).

Students usually enter the CDB graduate program through the Program in Molecular and Cellular Biosciences (PMCB). The first year of graduate studies in the PMCB program involves three laboratory research rotations and completion of conjoint courses that will also contribute to the fulfillment of CDB course requirements (see below).

General Timeline

At the completion of their first year, PMCB students must complete a written Comprehensive Examination (based on their first year courses). At this time, students must select a Ph.D. mentor and Graduate Program. To join CDB, students must select a Ph.D. mentor who is a member of the SoM Graduate Faculty (a student's mentor does *not* need to have an appointment specifically with the Department of Cell, Developmental and Cancer Biology).

During their second year, students must complete their remaining CDB course requirements, which include three (3) elective courses worth a total of at least 6 graded credits (not pass/fail); two (2) journal clubs associated with CDB or other programs that include presentations by the students; and regular participation in the CDCB Departmental Seminar course (described in more detail below).

During summer term of their second year, students must complete a [Qualifying Examination](#) (consisting of written and oral components), which will allow them to Advance to Ph.D. Candidacy. Upon completion of their Qualifying Examination, students must assemble a [Dissertation Advisory Committee](#) (DAC), subject to approval by the Graduate Program Director. Ph.D. Students must meet with their DAC in person at least every six months.

For the remainder of their graduate training, students must conduct independent research (under the direction of their mentor). Students must also regularly register for the CDCB Departmental Seminar course. This course includes regular attendance at the Basic and Translational Science Seminar Series (jointly sponsored by CDCB and the Knight Cancer Institute). As part of this course, all students in their second year (before taking their Qualifying Examination) must participate in a pre-seminar journal club (organized by the course director) to review a recent publication by the seminar speaker. In addition, all students who have passed their qualifying examinations (year 3+) are required annually to give a 30-minute presentation on their research. Students will receive written and oral evaluations of their presentations from attending faculty, with the goal of improving their presentation skills.

Other Requirements: Students are expected to participate in departmental functions related to the CDB Graduate Program, including participation in recruitment activities for new PMCB graduate students, the

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

annual OHSU Research Week, and in related functions designed to support their professional development (including attendance and presentations at professional meetings and publication of their research).

Once the members of a student's [DAC](#) agree that the student is ready to defend their dissertation, the student must assemble a Dissertation Defense Examination Committee (with the approval of the Graduate Program Director and Associate Dean of Graduate Studies). Students must then complete their written dissertation (as per OHSU guidelines) and successfully defend their research at a public examination.

- Year 1
- Complete PMCB requirements
 - Complete CON course requirements (CONJ 661, 662, 663, 664, 665, [one of 667, 668, 669], 650-ethics, 607-seminar series, 605, 601)
 - 3 laboratory rotations
 - Present research in rotation talk forum
 - Attend PMCB Seminars
 - Attend PMCB Journal Club
 - Successful completion of the comprehensive examination (CONJ 608A)
 - Select Program and Mentor
 - Recommended CELL courses (CELL 607)
- Year 2
- Complete any remaining PMCB CONJ course requirements, as needed
 - Attend and participate in [CDCB Departmental Seminars](#)
 - Attend and give presentations in at least two (2) Journal Clubs
 - Complete required and elective CDB courses
 - Complete three elective courses for a total of 6 graded credits.
 - CELL 601 Engage in research in dissertation laboratory (includes 2nd year pre-seminar journal club)
 - CELL 607 Attend CDCB Departmental Seminar Series
 - XXX 606 Participate in 2 journal clubs (from CDB or other programs)
 - Grant Writing & Qual Exam Prep (Fall or Spring)
 - Highly recommended to take the Vollum Scientific Writing Course
 - Successfully complete [Qualifying Examination](#)
- Years 3⁺
- [Advance to Ph.D. Candidacy](#)
 - Create a [Dissertation Advisory Committee \(DAC\)](#)
 - DAC meeting at least every 6 months
 - Engage in research in dissertation laboratory (CELL 603)
 - Attend CDCB Departmental Seminar Series (CELL 607)
 - Present your research progress in the annual CDB/CANB retreat (Years 3 +)

Average time to completion of Ph.D. in CDB is currently 5.5 years.

Links

[Basic & Translational Sciences Seminar Series](#)

[Basic Sciences Shared Administration Services](#)

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

[CDB Graduate Program](#)

[Center for Diversity & Inclusion](#)

[Graduate Studies – Forms and Policies](#)

[Graduate Programs Academic Regulations OHSU Code of Conduct](#)

Program Contacts

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Selection of a Faculty Mentor

Students must select a Ph.D. Mentor and Graduate Program. Mentors are not required to have an appointment in CDCB.

The student's selection of a mentor for the doctoral dissertation must be approved by the CDB Graduate Program Director and by the Director of the mentor's primary administrative unit.

- a) The Mentor must be a member of the SoM Graduate Faculty.
- b) Graduate Program Coordinator completes a Mentor Assignment form, and forwards to the Associate Dean of Graduate Studies.

Required Courses

1st Year PMCB Courses

All CDB students must successfully complete the following courses, unless granted an exception by the Program Director. In accordance with the guidelines for graduate students in the School of Medicine, CDB students maintain a grade point average of 3.0. Courses graded on a pass/not pass basis (P/NP) must be completed with a passing grade (P).

A. REQUIRED FOR ALL PMCB STUDENTS:

2020-21 Requirements

Choose 4 classes from the following –letter grade

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

- CONJ 661: Structure & Function of Biological Molecules – 4 credits
- CONJ 662: Genetic Mechanisms – 4 credits
- CONJ 663: Bioregulation – 4 credits (Signature required for non PMCB Students)
- CONJ 664: Molecular & Cell Biology – 3 credits
- CONJ 670: Foundations of Measurement Science – 4 credits (Signature required for ALL Students)
- CONJ 671: Analysis in Quantitative Science – 4 credits (Signature required for ALL Students)

Choose 2 Classes from the following Electives – letter grade

- CONJ 665: Development, Differentiation and Disease – 3 credits
- CONJ 667: Organ Systems – 3 credits
- CONJ 668: Molecular Biophysics and Experimental Bioinformatics – 3 credits
- CONJ 669: Principles of Chemical Biology – 3 credits
 - *Allowable PMCB Elective Substitutions:
 - MBIM 608: Advanced Virology
 - MBIM 612: Advanced Immunology
 - MBIM 615: Dynamic Interface Between Pathogen & Host
 - MGEN 622: Eukaryotic Genetics
- 19 Credits in CONJ 601: Research Rotation – pass/no pass

Required to complete during year one

- CONJ 607: PMCB Seminar Series – 1.5 credits (0.5 credits per term) – pass/no pass
 - CONJ 660: PMCB Research Rotation Talks – 1 credit – pass/no pass
 - CONJ 650: Practice & Ethics of Science – 1 credit – pass/no pass
- PMCB Comprehensive Exam

2nd Year CDB Courses

Electives

THREE ADDITIONAL ELECTIVE COURSES (>6 graded credits; any term). CDB requires that students successfully complete at least three elective graduate courses (for a total of at least 6 graded credits) that are offered by CDB or other OHSU graduate programs, prior to taking their Qualifying exam. These courses must be for a letter grade, not pass/fail. Additional CONJ courses are also acceptable as electives. Please see the section on [Course Descriptions](#) for some of the more popular electives taken by our students

Journal Clubs

A MINIMUM OF TWO JOURNAL CLUBS (total of at least 2 credits). Students are required to enroll in at least two quarters of journal club courses prior to taking their Qualifying Examination. Students are required to give presentations at these Journal Clubs for credit. Possibilities include the Cell and Developmental Biology Journal Club (*CELL 606*) and the Cancer Biology Journal Club (*CANB 606*); however, any journal club sponsored by a graduate program within the School of Medicine is acceptable.

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

CELL 606: Cell and Developmental Biology Journal Club discusses recent advances in Developmental and Cell Biology (broadly defined). Papers are usually chosen such that at least some of the data come from in vivo studies in a model organism (as opposed to cell culture, or purely in vitro methods for example). Junior students (second year and/or limited experience with this journal club) will receive a written critique of their journal club presentation that is meant to provide constructive criticism. Faculty members may assist with presentations if necessary.

Research Credits

Students who have not advanced to Ph.D. candidacy are required to register for at least 2 credits of CELL 601. If a graduate student fails (i.e. receives a grade of NP – No Pass) a term of research credits (CELL 601), the student is immediately placed on academic probation. The student is required to obtain a passing grade in the next term (and subsequent terms) of research credits or the student may be dismissed from the graduate program. The student is required to notify and meet with their dissertation advisor immediately upon receiving a failing grade on the research credits in any one term. The dissertation advisor will suggest a course of action that the student must follow in correcting academic performance. Students are also encouraged to meet with the Graduate Program Director for additional guidance.

Dissertation Credits

Ph.D. Candidates are required to register for at least 2 credits of CELL 603. If a graduate student fails (i.e. receives a grade of NP – No Pass) a term of dissertation credits (CELL 603), the student is immediately placed on academic probation. The student is required to obtain a passing grade in the next term (and subsequent terms) of research credits or the student may be dismissed from the graduate program. The student (in consultation with their mentor) is to schedule a DAC meeting immediately upon receiving a failing grade on dissertation credits in any one term. The DAC meeting must take place within two weeks of receipt of the failing grade on the dissertation credits. The mentor and DAC will suggest a course of action that the student must follow to correct their research program. Students are also encouraged to meet with the Graduate Program Director for additional guidance.

Seminar

CELL 607A: [CDCB Departmental Seminars](#) fall, winter and spring terms, after 1st year, all CDB students are required to enroll in and attend CELL 607A throughout their graduate training, which includes the [Basic and Translational Sciences Seminar Series](#): (BTS; jointly sponsored by CDCB and the Knight Cancer Center). Attendance is mandatory. Students who fail to maintain a passing grade in this course will be placed on immediate probation.

As part of CELL 607A, students in their second year of graduate training (year 1 in the CDB Graduate Program) are required to participate in a pre-seminar journal club, during which students will discuss selected papers by outside speakers. This journal club will be organized by the course director for 607A.

Also as part of CELL 607A, students who have completed their Qualifying Examinations will be required to give a 30-minute presentation each year on their dissertation research. In general, students will give their first presentation in the spring term of their 3rd year, and will continue to give subsequent presentations annually throughout their graduate training. Students will

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

receive oral and written critiques from participating faculty to help improve their presentation skills.

Course Waivers

If a student believes that they have completed an equivalent graduate-level course to any of these required courses, they may petition to have the course requirement waived. To petition for a waiver, the student should write a memo to the CDB Graduate Program Director, requesting that the course requirement be waived and explaining why the previous course is equivalent to the required course. A course outline or syllabus that describes the subjects covered by the previous course should be included with the memo. The students must also provide a copy of their transcript indicating that they passed the course with a grade equivalent to a "B" or better.

Grading

Student performance in graduate courses shall be evaluated using a letter grade system in which A is Exceptional, B is Superior, C is Average, D is Inferior and F is Failure. A "plus" (+) may be added to the letter grades B, C or D to indicate a higher level of performance at each grade level. A "minus" (-) may be added to the letter grades A, B, C or D to indicate a lower level of performance at each grade level. In calculating grade point average, the letter grades shall be converted to grade points as follows: A (4.0), A- (3.7), B+ (3.3), B (3.0), B- (2.7), C+ (2.3), C (2.0), C- (1.7), D+ (1.3), D (1.0), D- (0.7), F (0.0). Research registrations (course number 601) and dissertation registrations (course number 603) shall be graded on a Pass (P) or No Pass (NP) basis. Journal Club (course number 606) and Seminar registrations (course number 607) may be graded on either a letter grade or a P/NP basis, with the restriction that all students in that course must be graded on the same basis in any given term. For courses graded on a P/NP basis, the grade P shall indicate that the student received graduate credit for the course; a grade NP shall indicate that no credit has been given for the course. Courses graded on a P/NP basis shall not be used for the computation of grade point average. (See Article IX, General Scholastic Regulations in the Graduate Program Handbook))

Course Descriptions

CELL 613: Tissue Biology (4 credits). Winter term, yearly (depending on enrollment).

The mission of this course is to introduce students to tissue biology, a cutting edge subject at the intersection of stem cell, cancer, developmental and cell biology. Through this course, students will gain an in-depth understanding of the cellular architecture and physiology of tissues and organs, all in the context of modern biology's most provocative questions. This "flipped classroom" course begins with a comprehensive (12 classes) survey of basic histology. Before each class, students watch one of a series of high quality on-line lectures made by course faculty using "green screen" technology. Each lecture is supported by a detailed outline. In class, students examine histological slides using a fully annotated "digital slide box" program, guided by a comprehensive set of lab exercises and direct face-to-face discussion with course faculty. The course culminates with 8 student-led discussions of histology-related, cutting edge journal articles that focus thematically on specific organ systems. The theme for 2020 was stromal cells. We welcome students who have taken histology (e.g. through this course or through the medical school) to enroll in the "journal discussion" segment of the course (called "CELL/CANB 613"b"), for two credits.

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

CELL 615: Advanced Topics in Developmental Neuroscience (3 credits). Spring term, alternate years.

This course is designed to provide an initial overview of the major aspects of nervous system formation, followed by more in-depth presentations of specific topics in the field of neural development and differentiation. Emphasis will be on recent insights into the molecular and cellular mechanisms that underlie specific aspects of neural development, including patterning of the early nervous system, neurogenesis, neuronal migration and axonal outgrowth, synaptogenesis and plasticity, cell death, and neural stem cells in regeneration. Readings will be based selected reviews and articles from the current literature. Students and faculty will lead alternating interactive discussions that include critical analyses of significant research papers.

CELL 616: Cancer Biology (4 credits). Spring term, yearly.

The course consists of a comprehensive coverage of topics in cancer biology including mechanisms of carcinogenesis, the roles of oncogenes and tumor suppressor genes, molecular targets for novel therapeutic strategies, and an understanding of the pathogenesis of specific cancers such as breast, prostate, gastrointestinal, skin, and blood.

CELL 618: Mechanisms of Development (3 credits). Spring term, alternate years.

This course offers an advanced and in depth overview of a selected “hot” topic in the field of Cell and Developmental Biology. Topics covered in previous course offerings include noncoding RNAs, asymmetric stem cell division and endocytic regulation of signal transduction. The topics are explored primarily through student- and postdoc-led discussions of the current literature. For some topics, the course may require participants to write a section of a mini-review that can be submitted for publication. Participants have the option of enrolling in the course for credit or auditing the course with permission. All participants will be expected to contribute to discussion and writing of the mini-review.

CELL 620: Model Systems Biology (3 credits). Summer term.

This course provides an introduction to the biology and genetics of the major animal model systems as well as laboratory demonstrations of state-of-the-art techniques. Students will gain a solid understanding of how mice, zebrafish, *Xenopus*, chickens, and flies are used as tools to study key cell and molecular biology problems. This approach will help students better interpret the results of recent papers in major journals. This course should also aid in making informed choices about the design of qualifying exam proposals and dissertation topics. Grades will be based on student presentations of current topics and a final exam. Students at all levels are encouraged to participate.

CELL 601NN Nano Courses

Definition: A nano course refers to a short course, offered for 0.5 credits. They are intended to be special topics courses that capitalize on timely subject matter, visiting experts, and/or highlight new developments in a field. Flexibility in scheduling and course leadership (i.e. not part of the permanent curriculum) will insure these courses are nimble. Nano courses are only offered once.

Previously offered Nano Courses (courses may be repeated in future years):

- Novel 3D Cell Culture Platforms for Studying Cellular Biology and Disease Mechanisms (Spring 2015)
 - o Recent advancements in 3D cell culture methods are rapidly creating new approaches for addressing critical mechanistic questions for both normal and disease cellular processes in

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

various organ systems. This course will highlight the power and utility of these approaches in regards to the types of questions they are currently being used to address and the experimental paradigms in which 3D culture models can be tailored to various research topics. This course will be composed of both a lecture series and hands-on laboratory training workshops using a 3D intestinal epithelial culture system.

- CRISPR-Cas9 system (Fall 15)
 - o This course will discuss the design and various applications of cutting-edge genome editing technologies. The students will be taken through steps of designing guide RNAs, ways to introduce gRNAs and Cas9 into various animal models, and how to screen for resulting mutations. Advanced applications of the CRISPR-cas9 technology, including knock-ins, RNA editing, and others will also be discussed.
- Biology and Pathology of Extracellular Vesicles (Spring 16)
 - o This course will discuss the biology of extracellular vesicles as cell-cell signaling devices. The students will become familiarized with differences in vesicle types and biogenesis as well as the diversity of EV cargo. We will also review available evidence for the action of EV vesicles on target cells, with emphasis on their role in the cancer microenvironment. In addition, students will become familiarized with technologies currently used in analysis of EV.
- A Hands-On Introduction to RNAseq (Spring 17)
 - o This course will discuss design of biomedical experiments including generation of RNAseq data; genome alignment and bias reduction of RNAseq data; basic differential expression analysis; and biological interpretation of expression differences based on curated knowledge of biological systems such as pathways, ontologies and networks. The students will be taken through hands-on exercises to design an RNAseq study, train with raw and processed RNAseq data, explore differential expression and interpret results.

Academic Progress

In accordance with the guidelines for graduate students in the School of Medicine, CDB students must maintain a grade point average of 3.0 in all courses taken for credit. (A = 4; B = 3; C = 2; D = 1). Courses graded on a pass/not pass basis (P/NP) must be completed with a passing grade (P); however courses graded on a P/NP basis do not contribute to calculation of the grade point average. If a student's cumulative grade point average drops below 3.0, the student will be placed on academic probation, requiring that student bring up their grade point average to at least a 3.0 within one academic term. Note that academic probation may limit the availability of some kinds of student loans or other financial aid (for further information contact Registrar's office). A student that fails to do so may be recommended for dismissal for inadequate scholarship, at the discretion of the CDB Graduate Program.

Students must earn a grade of "B" or better in required courses (defined in Section II). A student who receives a "C" or worse grade for a required course will be placed on academic probation. To remove academic probation due to a poor grade for a required course, the student must achieve a grade of "B" or better for that course within the next 12 months. A student who fails to remove academic probation

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

due to a poor grade in a required course within the one-year time limit will be subject to dismissal from the Program.

In accordance with the guidelines for graduate students in the PMCB, all students must successfully pass their Comprehensive Examination (at the end of their first year) and their Qualifying Examination (at the end of their second year). CDB-specific requirements for the [Qualifying Examination](#) are summarized below. Students who fail to pass either of these examinations will be subject to dismissal from the Program.

Graduate students must make appropriate progress in research activities. A CDB student who receives a grade of not-passed (NP) for a research registration (CELL 601 or 603) will immediately be placed on academic probation. Academic probation status will be removed when a grade of passed (P) is received for a subsequent research registration. Students who receive a grade of NP for a total of two terms of research registration (CELL 601 or 603) will be subject to dismissal from the Program.

Following Advancement to Ph.D. Candidacy, students must meet with their [Dissertation Advisory Committee \(DAC\)](#) on a regular basis. Ideally, students should assemble and meet with their DAC within 2 months after completing their Qualifying Examination. Thereafter, students are expected to meet with their DAC approximately every six (6) months, until the committee decides that the student is ready to defend their dissertation. Students who do **not** meet with their DAC within six months of advancement to candidacy or within 12 months of a previous DAC meeting will be subject to disciplinary action, including dismissal from the program.

In accordance with the guidelines for graduate students in the School of Medicine, CDB students must successfully defend their dissertation research within 7 years. Under exceptional circumstances, students may request an extension of this deadline by petitioning the Graduate Program Director, who in turn may present the petition to the Committee on Graduate Studies. A successful petition will require a clear explanation of why the extension is required, and a specific plan (with timeline) for completion of the dissertation if an extension is granted. Students who fail to successfully defend their dissertation within this period will be subject to dismissal.

Training in the Responsible Conduct of Research

The National Institutes of Health requires continued ethics training for all trainees, fellows, participants, and scholars receiving support through any NIH training, career development, research education, and dissertation research grant ([NOT-OD-10-019](#)). To meet this requirement, all graduate students are required to:

- Complete CONJ 650 The Practice and Ethics in Science during their first year
- Complete second ethics course during their 5th year

Comprehensive Exam

At the completion of their first year, PMCB students must complete a written Comprehensive Examination (based on their first year courses).

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Qualifying Exam

Overview

The purpose of the Qualifying examination in CDB is two-fold. First, the examination will determine whether the student has acquired sufficient knowledge and skills to pursue their Ph.D. dissertation training. Second, the examination will provide the student with the opportunity to practice the preparation of a research proposal that may be subsequently developed for submission to funding agencies.

- The Qualifying Examination consists of a **written** and **oral** component. The candidate must pass both the written and oral portions of the examination. **A period of 2.5 hours should be scheduled for the examination.**
- The **written** component should resemble a NIH-style NRSA grant proposal that is prepared independently by the student and that is focused on their general area of research. (See detailed guidelines below). **The specific topic of the qualifying examination can be on the student's dissertation project or a related research question of the student's choosing. However, one significant component of the proposal (e.g. at least one specific aim) must be completely independent of the mentor's current research program.** Students may discuss the general concepts associated with this independent aim with other laboratory members (including other students and postdoctoral fellows), but they are to design the hypothesis and experiments of this aim without input from their graduate mentor.
- **The oral examination** will probe the breadth of the student's general knowledge **and also the depth of the student's understanding of their research proposal.** The oral component of the examination will consist of a 20-30 minute presentation by the student on the topic of the written proposal. Audio-visual aids (including PowerPoint presentations) may be used.
- Members of the student's Qualifying Examination Committee will then ask the student a series of questions on the proposal and related scientific areas. Because the topic can be on the student's intended dissertation project, the student will be required to demonstrate rigorous understanding of their written research proposal. **Thus, all proposed methodologies, anticipated results, potential pitfalls, and alternative plans should be clearly stated and understood by the student.**
- Questions from the Qualifying Examination Committee will focus primarily on issues pertaining to the proposal. However, the student is officially responsible for all areas of cellular and molecular biology that have been covered during the first two years of graduate study. Therefore, students also should expect questions on general knowledge that pertain to the scientific background of their research proposal, in addition to more specific questions pertaining to their proposed **experiments. The experiments. The** chairperson of the committee will establish the length and format of the questioning period, and will determine when the exam has concluded.

The Qualifying Exam takes place at the end of the second year of graduate studies. Although the Qualifying Examination is part of the PMCB training program, the CDB Graduate Program will coordinate and administer examinations taken by all students in the program.

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Specific guidelines and timeline for CDB Qualifying Examinations can be found on the CDB website at **CDB Qualifying Examination**.

Eligibility

Before taking the Qualifying Examination, the student must be in good academic standing and have completed the CDB course requirements or have received approval to defer course requirements from the Graduate Program Director.

Timeline and Description

Students are expected to complete their Qualifying Examination by no later than the end of the summer term of their 2nd year in graduate school, in compliance with the PMCB requirements. Qualifying Examinations in the CDB Graduate Program are generally taken during the first two weeks in July. In the case of a re-examination, the Examination Committee will define a specific deadline for completion of the second examination. The exact dates will vary slightly from year to year; here are the approximate target dates for 2020:

- **Winter term, 2020:** Review the CDB Qualifying Examination requirements with the CDB Graduate Program Director (currently Philip Copenhaver). Take the 607 Grant Writing & Qual Exam Prep and/or the Vollum Scientific Writing Course (both are recommended)
- **On or before May 1 of their second year:** Students may suggest faculty as potential members of their Qualifying Examination Committee to the Graduate Program Director
- **On or before May 22nd,** students must submit their 2-page **Qualifying Examination Prospectus** to the Graduate Program Director. The Graduate Program Director will inform the student of the faculty members who will serve on their Examination Committee and will forward copies of the Prospectus to the Committee.
- Once a student has submitted their Prospectus, they must arrange with the Graduate Program Coordinator (Lola Bichler) to reserve a location, date, and time for their examination.
- **By June 5th:** the members of the student's Qualifying Examination Committee will provide the students with constructive feedback about any weaknesses or specific suggestions for improving their proposal. At this time, students may request clarification of any suggestions provided by the Examination Committee, but they may **not** solicit any additional input from the Committee prior to the examination.
- **At least 10 days before your examination** (to be scheduled during the first two weeks in July) **submit your final proposal** to your Qualifying Examination Committee members; also send copies to the CDB Graduate Program Director, the Graduate Program Coordinator, and the PMCB Coordinator.
- **Students must also submit a letter from their dissertation advisor/mentor** that describes the advisor's role during preparation of the proposal (see "Role of Advisor/Mentor" as described above).

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

- **All exams will be scheduled no later than the week of July 14th.** This complies with the graduate studies expectation that examinations must be completed at least ten days before the beginning of the fall term.
- At the completion of the Examination, all Committee members must sign the **Qualifying Examination Form**, which is to be submitted to the Graduate Program Coordinator.

Qualifying Exam Committee

The Qualifying Examination Committee will consist of five faculty members who shall be appointed by the Graduate Program Director (with approval of the Associate Dean for Graduate Education). Students may suggest names of three faculty members to be part of their Examination Committee for consideration by the Graduate Program Director. Qualifying Examination Committee members must be members of the SOM Graduate Faculty but do not need to be affiliated with the Cell and Developmental Biology Graduate Program.

The student's advisor may attend the Qualifying Examination as a non-voting member, but the advisor may not ask questions (or answer them). The Examination Committee may request input from the advisor during their deliberation of the student's performance, but this is not required.

Role of Advisor/Mentor

The Qualifying examination is meant to provide an objective evaluation of a student's ability to think creatively and independently about their scientific project. During the preparation of both the prospectus and the actual proposal, the student is encouraged to seek constructive criticism by other colleagues. As outlined in the PMCB academic guidelines, students may discuss topics and proposed experiments with all sources (fellow students, post-doctoral fellows, faculty, and visiting scientists), but none of them may be involved in any aspect of the student's written proposal. Students may also seek general assistance in scientific writing and proofreading from their colleagues. However, students are NOT permitted to ask their advisor or other members of the Qualifying Examination committee about the specific scientific content of the proposal, nor may they request committee members to review drafts of the proposal prior to the examination. Preparation of the written proposal is an intrinsic part of the Qualifying Examination and must represent the student's own ideas and development of the research topic. Students should include a brief discussion of expected outcomes, potential pitfalls, and alternative strategies for each of the aims of their proposal.

At least one aim of a student's Qualifying Examination Proposal must be generated completely independent of their advisor's current research or research being conducted by other laboratory members. Likewise, this aim must **not** be derived from grant applications prepared or submitted by any other individuals. The goal of this requirement is for the student to demonstrate truly independent thinking. Students should identify a novel question in the field that relates to their overall project, investigate potential strategies (and methods) for investigating this question, and develop a testable hypothesis that will address this question experimentally. Students should be familiar with overall strengths and weaknesses of any methodologies they propose for this aim, although they are not expected to have gained experience with them.

The students' mentor is not permitted to edit or comment on the written proposal. Neither is the mentor nor another faculty member, permitted to coach the student in a rehearsal of their oral

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

presentation. **The student must submit a signed letter from their dissertation advisor** describing in specific detail the roles of the advisor and the student in the development of the hypothesis and research plan in this proposal. In this letter, the dissertation advisor must confirm that they have NOT contributed to the written portion of the examination and that the student has NOT used any of their advisor's writing within the proposal. The Qualifying Examination Committee has two weeks from receipt of the written proposal to request more information from the dissertation advisor, if deemed necessary.

Format of Written Proposal

Before preparing the actual research proposal, the student will submit a two-page, single-spaced prospectus to the CDB Graduate Program Director (currently [Philip Copenhaver](mailto:copenhav@ohsu.edu); copenhav@ohsu.edu). Copies should also be sent to the PMCB office (pmcb@ohsu.edu) and to the CDB Graduate Program Coordinator (currently [Lola Bichler](mailto:bichler@ohsu.edu); bichler@ohsu.edu). This prospectus should define the topic of their intended Qualifying Examination proposal, including a summary of potential aims to be addressed and an outline of the experimental plan (including a summary of key methods). A short (1-3 sentence) summary of potential pitfalls and alternatives should also be included.

The prospectus will then be provided to the members of the Qualifying Examination Committee for their evaluation. Committee members may either approve the prospectus without comment, or they may provide the student with specific suggestions about how the experimental design should be modified when the student prepares the actual Qualifying Examination Proposal. This is the one (and only) opportunity for the student to receive input from the Committee Members before the examination. Students may request clarification of specific comments offered by the Committee, but they are not to seek additional feedback on drafts of their Proposal prior to the Examination. Committee members are to provide comments to the student within 10 days after receiving the Prospectus, or the student may assume that the Committee members find have determined that the Prospectus represents an acceptable template for preparing their actual Qualifying Examination Proposal.

Preparation of the Qualifying Examination Proposal: The written proposal should use the general format of the "Research Plan" section of an NIH NRSA Grant, which is detailed below. The research plan should have the substance, content, and original thinking that is appropriate for such an application. It should be organized into the following sections:

Document Format: Use an Arial, Helvetica, Palatino Linotype, or Georgia typeface, a black font color, and a font size of 11 points or larger. Type density must be no more than 15 characters per inch and no more than six lines per inch (do not reduce line or character spacing). At least one-half inch margins should be used.

Page 1: Specific Aims: State concisely the overall goals of the proposal.

- Include, a concise rationale for the proposal: what is the primary question to be addressed? Why is it important? How will the proposal investigate a specific problem, challenge an existing paradigm, or address a critical barrier in the field?
- State the overall hypothesis of the proposal aim concisely and clearly. Likewise, include a brief summary of the specific hypotheses/questions to be tested in each aim and the types of methods that will be used to test these hypotheses.

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

- Summarize the **expected outcome(s)** of the proposed dissertation research project (what will your experiments accomplish if they succeed?). Also summarize the **impact** that the proposed research will have on the field (1-2 sentences).

Pages 2-7: Research Strategy (six pages total). Organize the Research Strategy in the following manner.

Start each section with the appropriate section heading: (i) **Significance**, (ii) **Innovation**, (iii) **Approach** (containing the Specific Aims), (iv) **References** (or **Literature Cited**).

- Proposals typically consist of two-three Specific Aims. Although there is flexibility in the formatting of the aims, each aim should include (i) a short **Introduction** (or "**Rationale**"), (ii) **Preliminary Data** (from your laboratory), (iii) **Experimental Methods**, and (iv) **Expected outcomes, potential pitfalls, and alternatives**.
- Include citations for published results and key experimental methods within the Research Strategy section, and provide the full references in the References (or "Literature Cited") section.
- Note that the Bibliography section/Reference list is NOT included in the page limit, and there is no limit to the number of references that may be cited.
 - (i) **Significance** (about ½ page)
 - a. Explain the importance of the problem or critical barrier to progress in the field that the proposed project addresses.
 - b. Explain how the proposed project will improve scientific knowledge, technical capability, and/or clinical practice in one or more broad fields.
 - c. Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed if the proposed aims are achieved.
 - (ii) **Innovation** (about ¼ page). Explain how your approach provides novel or innovative ways of addressing your questions.
 - (iii) **Approach**
 - a. For each aim, describe the overall strategy, preliminary data, methodology, and analyses to be used to address the specific aims of the project. Include how the data will be collected, analyzed, and interpreted. Include a concise discussion of appropriate controls and sample sizes.
 - b. Discuss the anticipated outcomes of your experiments (if they succeed as you predict), and alternative outcomes (if they do not). Include a discussion of potential problems and pitfalls that you might encounter, and alternative strategies and methods that you could use to overcome these problems.

Note that these page limitations may preclude a detailed presentation of all the methods used in the proposal. However, the candidate should be prepared to discuss the proposed experimental methods fully during the oral presentation, including the potential strengths and weaknesses of each method, and alternative strategies that could be used to address each research question (at least in theory).

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Format of Oral Exam

- Once the Qualifying Examination Committee has assembled, the student will be requested to leave the room briefly for a confidential review of the student's qualifications by the Examination Committee.
- The Examination will commence with an oral presentation of the proposal by the students (20-25 minutes). Students may use appropriate audiovisual technologies (including PowerPoint presentations). If the oral presentation exceeds the allotted time, the Committee Chair may end the presentation and transition to the next phase examination. Students are therefore encouraged to prepare presentations that can be completed in 20 minutes.
- The Committee will then proceed with the Oral Examination in a manner to be determined by the Chair. In general, each committee member will ask a short series of questions about different aspects of the written proposal or oral presentation. Questions may be focused on conceptual or technical aspects of the proposal, including scientific background, key methodologies, expected outcomes, and potential pitfalls. After one round of questions, the Chair may solicit additional questions from the Committee members. The Chair will determine when the examination is complete.
- Students may refer to their PowerPoint presentations or use other methods to address questions raised by the committee (including whiteboard or other visual aids), but they may not use internet-based tools to answer questions. Likewise, Committee members are expected to refrain from the use of internet-based services or Wi Fi communications during the examination (except emergency situations).
- At the completion of the examination, the student will again be required to leave the room while the Committee deliberates about the grading of the examination. The student will then be invited back into the room to discuss the outcome of their examination with committee members.

Preparation for Oral Exam

- Students are strongly encouraged to practice their oral presentations multiple times before the examination. Students may request that fellow graduate students attend these practice sessions and provide critical feedback (similar to the preparation of a presentation at a professional meeting). However, as with other aspects of the Qualifying Examination, neither the student's mentor nor members of the Examination Committee participate in these practice sessions.

Outcomes

The written and oral sections of the examination will be independently evaluated and scored according to the following categories:

- Pass (unconditional)
- Pass (conditional)
- Fail (Retry)
- Fail (Final)

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Pass

If a student receives a Pass on both components of the examination, the student will be informed that they have successfully advanced to Ph.D. candidacy, and that they should proceed with the assembly of their Dissertation Advisory Committee as soon as possible.

Conditional Pass

If a student receives a Conditional Pass on either component of the Examination, the Committee Chair will inform them immediately about the specific guidelines and timeline for completing any conditions imposed by the Committee. This information will also be sent via email to the student, their advisor, and the Graduate Program Coordinator.

Students who are given a **conditional pass** for either component of the examination will be required to undertake a variety of specific activities to address the weaknesses identified by the committee. Specific activities may include rewriting of part or all of the proposal; completion of additional course presentations in journal clubs or joint laboratory meetings; and/or re-examination by the Examination Committee on specific areas of knowledge.

Fail

- **If a student receives a Failing grade** for either component of the examination, they may be given the opportunity to repeat the Qualifying Examination within 2 months of the initial examination. The option of repeating the Qualifying Examination is at the discretion of the Examination Committee. If the Committee gives the student the option of repeating the Qualifying Examination, the student will be given specific guidelines for how to prepare a revised Qualifying Examination Proposal. The Graduate Program Director will then establish a new timeline for submission of the revised proposal and completion of the second Qualifying Examination.
- The second Examination Committee will either pass the student or recommend that the student not be admitted to candidacy for the Ph.D. degree in Cell and Developmental Biology.
- If the Examination Committee declines to offer the option of a second Qualifying Examination, or the student also fails a second Examination, the Committee may offer the student the option of completing a **Master's Degree (with thesis)**. In this event, the student must assemble a Thesis Advisory Committee and complete all the requirements for a Master's Degree with Thesis, as specified in the bylaws and [Guidelines](#) for Graduate Studies.

Timeline for Re-examination

The option of repeating the Qualifying Examination is at the discretion of the Examination Committee, but must be completed by the end of the fall term.

Outcome for Re-examination

Outcomes for the Re-examination are the same as for the original Qualifying Examination, except that a student shall not be given any additional opportunities to re-take the examination.

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Advancement to Ph.D. Candidacy

Once a student has successfully passed their Qualifying Examination, the Graduate Program Director must submit an “Advancement to Ph.D. Candidacy” form on behalf of the student to the Associate Dean for Graduate Education.

Dissertation Advisory Committee

DAC Formation

Immediately following successful completion of the Qualifying Exam, students must assemble a Dissertation Advisory Committee (DAC). Students should consult with their mentor about faculty to include on the DAC, and they may also request guidance from the Graduate Program Director or other faculty. The student's DAC must consist of the mentor and at least three other faculty members, with at least one committee member from outside the Department of Cell, Developmental and Cancer Biology; faculty with joint appointments in CDB may fulfill this requirement. Committee membership must be approved by the CDB Graduate Studies Committee. Members of this committee may also serve subsequently on the Dissertation Examination Committee (at the discretion of the student and their mentor).

Members of this committee should be chosen based on their research area or technical expertise. The main purpose of this committee is to provide the student with regular periodic guidance throughout the remainder of their dissertation research. DAC meetings also provide important opportunities for participating faculty members to offer suggestions about ongoing experiments and communicate possible concerns that need to be addressed in a timely manner. In addition, the DAC should ensure that the student is making consistent progress towards completing their Ph.D. project within the required timeline (as noted above). Students should schedule meetings with their DAC at least every six months. Program Directors may include members that are not graduate faculty or are from outside OHSU, with the approval of the Associate Dean for Graduate Affairs. The CDB Graduate Program Director must submit a letter to the Associate Dean requesting their appointment to the DAC, with a rationale for this choice and a current version of their curriculum vitae.

Guidelines for assembling a DAC (complete guidelines can be found at this [link](#)):

- At least four faculty members (including the student’s advisor) with expertise in one or more aspects of the student’s project and who are familiar with the requirements of the graduate program for completion of a Ph.D.
- A majority of DAC members must be members of the Graduate Faculty. OHSU faculty from outside the Graduate Faculty may be included.
- One member may be from outside the university with the approval by the Associate Dean for Graduate Studies (as described above). No more than two DAC members may lack prior experience with DAC committees, and at least one member must have been on a DAC for a graduated student.
- DAC Chair: One DAC member, not the mentor, with significant experience in mentoring graduate students, and having served on a DAC before.

DAC members may be added or removed with the approval of the Program Director and Associate Dean of Graduate Studies. Following the change, the DAC composition will still adhere to the above requirements. Typically, DAC members will be invited to serve as part of the student’s Dissertation

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Examination Committee; however, in consultation with their mentor, students may choose to omit selected DAC members from their Defense Examination Committee.

Student Responsibilities

Prior to a DAC meeting, students will submit a written summary of their recent research progress and prior DAC meeting summaries to the committee members, using the Dissertation Advisory Committee Meeting Summary Form. For students who have just completed their Qualifying Examination, this summary can consist of an outline of proposed aims. For more advanced students, this summary should include the goals identified by the committee at the previous DAC meeting, and a description of the student's research to address these goals (including successes and problems).

Committee Responsibilities

- Evaluate student progress toward degree.
- Provide critical input and advice that will facilitate the student's completion of their Ph.D. in a timely manner.
- Provide additional mentorship to the student as needed (including discussion of the student's career goals, as appropriate)

Meeting Summaries

One week prior to each committee meeting, a short report that summarizes the issues raised during the meeting should be prepared by the student (with input from the mentor) or by the DAC chair. The DAC chair will then circulate the draft report to the other committee members for their input and revision. After incorporating any revisions, chair will subsequently distribute a revised copy of the DAC summary to the student; to all members of the DAC; to the Graduate Program Director and Graduate Student Coordinator (LB); and the Graduate Studies office.

The summary should include:

- 1) Date, participants, and absent members if necessary.
- 2) Summarize the student's progress since the previous DAC meeting.
- 3) Summarize any significant problems or issues that need to be addressed.
- 4) Summarize the goals that the student should attempt to accomplish in the next 6 months.
- 5) When appropriate, summarize the student's future plans/career goals.
- 6) Estimate of date of completion (this will be more precise as student advances).
- 7) When appropriate, Date when DAC agrees that the student is ready to write their dissertation.

Student Seminar – Third Year+

(Third Year through completion of the Ph.D.) Following the completion of their Qualifying Examinations, students will present a 30-minute research seminar during the third year of graduate studies, as part of CDCB Departmental Seminar course. Typically, students will give their first research seminar in spring term following their Qualifying Examination. Subsequently, students will present research seminars once a year (on average) until they are approved to defend their dissertation. Students will be given written and oral critiques on their presentations from members of the faculty and their peers, with the goal of helping to improve their presentation skills. A meeting with the Dissertation Advisory Committee should be scheduled as soon as possible after the student's seminar to discuss the project and future directions.

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Dissertation Defense/Oral Examination Committee

The Oral Examination Committee is usually comprised of the members of the student's Dissertation Advisory Committee, plus one member who is not a member of the student's Dissertation Advisory Committee.

Students may request permission to replace one of the committee members by a recognized scholar who is not a member of Graduate Faculty. Requests to appoint an outside member to the Advisory Committee must be supported by a letter from the Program Director and a copy of the individual's curriculum vitae.

Scheduling an Oral Examination/Dissertation Defense

CDB requires that the Dissertation Advisory Committee must meet to review and approve the proposed dissertation research before a dissertation defense can be scheduled. The Chair of the Dissertation Advisory Committee should send a memo to the Program Director, with copy to Graduate Program Coordinator, giving approval of the dissertation project and approval for scheduling the oral dissertation defense.

Preparation and Submission

Candidates for the Ph.D. degree must present a written description of the experimental investigation carried out during their course of study in the form of a dissertation. A Ph.D. dissertation should include (1) an introductory chapter that defines the question that was addressed by the graduate student, including a discussion of past research in the field that is relevant to the student's dissertation; (2) results of independent research conducted by the graduate student that is equivalent to at least one publishable manuscript; and (3) a concluding chapter that summarizes the key advances that are described in the dissertation and future directions for subsequent research in the field. Manuscripts that have been submitted for publication can be used as chapters of the dissertation, with appropriate formatting to meet the requirements of OHSU dissertations. Appendices describing methodologies or additional projects that were conducted by the graduate student may also be included at the discretion of the student and their advisor. Additional information on the format of the dissertation and the oral defense examination should be obtained from the [Guidelines and Regulations for Completion of Masters and Ph.D. Degrees](#), or by contacting the office of the Associate Dean for [SoM Graduate Studies](#).

A copy of the complete dissertation must be submitted to all members of the Dissertation Examination committee at least two weeks before the date of the examination. Students should provide paper copies to each committee member, unless otherwise instructed by the members. Students may also provide committee members with individual chapters before the final submission deadline, if the examination committee members approve.

Dissertation Seminar

The general format for the Dissertation Seminar by the Ph.D. candidate is as follows:

- Just before the start of the examination, members of the Oral Examination committee will meet privately to review the student's qualifications for completing the Ph.D. and discuss any concerns pertaining to the written dissertation.

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

- The chair of the Dissertation Defense Committee calls the examination to order, and informs the audience of the overall format of the examination. At the discretion of the chair, audience members are usually requested to withhold questions until the completion of the public seminar given by the candidate. Audience members are also invited to attend the second phase of the examination (described below) but they may not ask additional questions at that time.
- The student's mentor then introduces the student to the audience.
- The student then gives a formal seminar describing their Ph.D. research.
- At the conclusion of this public seminar, the student and their committee will continue the second phase of the examination (typically in a separate conference room). At the direction of the chair, committee members will ask the student to address issues and questions pertaining specifically to their dissertation research. The committee will continue this phase of the examination until the chair concludes that the examination is complete.
- All committee members will then sign and date the Oral Examination form, and indicate whether they find that the student has passed or failed the Dissertation Defense Examination. Note that the decision to pass a student requires approval by the majority of the committee members but does not need to be unanimous.

CDB Graduate Program Executive Committee

This committee will serve as general oversight of the CDB graduate program. This committee will also serve as the PMCB departmental Qualifying Exam subcommittee. This committee will also review and approve appointments to Dissertation Advisory Committees, as needed.

Terminal Master's Degree (for programs with M.S. degree option)

Master's Degree: Cell and Developmental Biology Graduate Program will not routinely offer a Master's Degree. However, under special circumstances, a graduate student may petition the Graduate Program Director in writing to allow the student to complete a terminal Master's Degree. Successful completion of the Qualifying Examination to advance to Ph.D. candidacy is not required for a Master's Degree; hence, students who do not pass their Qualifying Examination may be offered the option of pursuing a terminal Master's Degree (at the discretion of their Qualifying Examination Committee).

A written thesis is required to earn a master's degree. In addition, a Master's thesis defense examination must take place, with the same requirements as for the Ph.D., except the number of credit hours required (45 vs. 135 credit hours). A thesis advisory committee (TAC) is required, the composition of which is in keeping with the guidelines for a Dissertation Advisory Committee (DAC; see above).

Ethical and Professional Behavior

CDB graduate students are expected to maintain high ethical standards. Graduate students should demonstrate honesty in all aspects of research activities. Student should learn about and avoid sources of error in scientific research. It is essential that students do not misrepresent scientific findings or misappropriate credit. All graduate students are required to take a course concerning ethics and science, and participate in refresher/update courses at least every four years. Students should show cooperation, responsibility, and respect in training with other students and faculty. Students should be considerate of the cultural and individual diversity of their colleagues.

GUIDELINES, GRADUATE PROGRAM IN CELL AND DEVELOPMENTAL BIOLOGY (CDB)

(Sponsored by the Department of Cell, Developmental and Cancer Biology) revised 2020

Students who are involved in unethical or unprofessional conduct such as cheating, misrepresentation of research findings, plagiarism (failure to credit the original author), or disruption of the learning process are subject to disciplinary action including dismissal from the department.

It should also be noted that students observing unethical behavior by students, faculty, or others on campus are obligated to bring these transgressions to the attention of the appropriate person.

See the [OHSU Code of Conduct](#) for further information.

Time Limit for Completing Degree Requirements

The current policy of the Graduate Council for the School of Medicine is that students must complete all requirements for the Ph.D. within 7 years of matriculation. Students that do not complete degree requirements within this deadline may be dismissed from the graduate program. Under unusual circumstances, graduate programs may petition the Graduate Council for an extension beyond this 7-year limit for specific students. Students, mentors, and the Dissertation Advisory Committee should consider this deadline when evaluating dissertation research goals and progress.

Non-compliance

Non-compliance with any of the CDB requirements can and will result in the revocation of certain program privileges, academic probation and possible dismissal from the graduate program.

Grievances

The procedure for handling grievances is outlined in the OHSU Graduate Studies Handbook.

Exceptions

No exceptions from the policies and procedures described in these guidelines can be made without approval by the CDB faculty. In matters related to courses, exceptions must first be approved by the CDB Graduate Studies Committee before review and consideration for approval by the CDB faculty.