PROGRAM FOR THE Ph.D. DEGREE

Department of Molecular, Cellular and Developmental Biology (MCDB)
University of Colorado, Boulder

MCDB offers a Ph.D. degree in biology. Students in the program take courses, serve as teaching assistants, begin independent research, pass preliminary and comprehensive examinations, and are then admitted to candidacy for the degree, which is awarded after successful preparation and defense of a thesis. The University's guide and requirements for graduate study are at https://www.colorado.edu/mcdb/graduate-program.
Students must adhere to Graduate School and Departmental rules and must participate actively in the intellectual life of MCDB.

A STATEMENT ON DIVERSITY

We are horrified by the recent killings of George Floyd, Ahmaud Arbery, Breonna Taylor and many other racially motivated incidents that have been ongoing for decades. We stand in solidarity with all who are speaking out against racial injustice. MCDB desires to create a welcoming environment for all, but we recognize we still have a long way to go to increase diversity throughout our department. With this recognition, MCDB has formed a Committee on Equity and Justice, which is identifying specific areas for improvement and making recommendations to the Chair on action items. MCDB is also in the process of hiring a full-time diversity coordinator to oversee these efforts. We welcome your input on how to make MCDB a more inclusive community.

ENTRANCE REQUIREMENTS

Background necessary for the program includes undergraduate courses or equivalent experience in molecular biology, genetics, cell biology, developmental biology, basic chemistry, and biochemistry. Applicants are also expected to have some prior research experience. Students accepted with background deficiencies may acquire proficiency in these areas by taking appropriate undergraduate or graduate courses. The GRE exam is not required. The University requires that students whose native language is not English take the TOEFL or IELTS exam.

ADVISING

At the start of the first semester in the program, each student must meet with members of the Committee on Graduate Student Affairs (COGSA). COGSA serves as the first-year student advisory committee, which will 1) check for possible deficiencies in the student's background and suggest corrective courses or research; 2) advise the student on any matter throughout the first year; and 3) evaluate the student's progress and eligibility for continued enrollment. The fall meeting between the student and the COGSA covers first-year teaching assignments, laboratory rotations, and discussion of the Core course program. The spring meeting between the student and the COGSA covers the student's progress and eligibility for continued enrollment and discussion of the student's proposed thesis lab. After choosing a laboratory for thesis work and while preparing for the Comprehensive Exam during the second year, the student, with the advice and consultation of the thesis advisor, forms a Thesis Committee, which replaces the COGSA in its advisory role (see below).

COLORADO RESIDENCY

First-year students who are US citizens must obtain a Colorado Driver's License within 30 days of arrival in Colorado (the DMV deadline) to begin the process of establishing Colorado residency. The paperwork for establishing Colorado Residency must be filed with the Registrar during the second semester of the first year; petition submission opens typically in April and ends in July and it is the students' responsibility to check as deadlines may change from year to year. If residency has not been established by the beginning of the second year, the student is responsible for the non-resident portion of tuition that exceeds the resident assessment. Please refer to the following link for residency information: **https://www.colorado.edu/registrar/students/state-residency/admitted/faqs**

COURSE OF STUDY

All students are expected to acquire basic proficiency in molecular biology and genetics, cell structure and function, and developmental mechanisms through laboratory research, coursework, and teaching. Thirty credits of coursework are required by the Graduate School for the Ph.D.. program. This is in addition to thirty credits of dissertation research required to graduate with a Ph.D.. Students are expected to actively participate in the intellectual life of the MCDB through regular attendance at seminars, weekly research talks by students and postdoctoral fellows, (MMB – Mostly Molecular Biology) attendance at departmental retreats, and participation in relevant journal clubs.

Laboratory Rotations: Students must rotate in four different laboratories during their first academic year in the program; each rotation is approximately eight weeks in length. A rotation performed during the summer preceding the first year cannot replace any of the academic year rotations. A student cannot rotate in a lab in which they worked as a technician or performed research as an undergraduate at CU (but may consider it for thesis research as described later in this document). For two semesters of rotations, students receive twelve semester hours of academic credit under the course name MCDB 6000: Introduction to Laboratory Methods, where each laboratory is assigned a different section number. Students will be assigned a grade in MCDB 6000 based on their performance during rotations.

Selecting Rotations: Students are responsible for identifying their own rotations. Students should reach out to prospective rotation labs well before the rotation start dates to confirm availability. Students must inform the Graduate Coordinator Sarah.Morehead@Colorado.EDU with their lab rotation choice at least one week prior to the rotation start date. Conflicts will be resolved by COGSA. Students are required to rotate in a MCDB lab for their first rotation. Students are highly encouraged to do their subsequent rotations in MCDB but can perform them in other laboratories at CU with prior approval by COGSA.

Rotation Expectations: For professionals in training, it is not appropriate to require a minimum number of hours for rotation work. Strong self-motivation is an essential characteristic for an independent scientist, and we expect our students to demonstrate this quality throughout their training. In this regard, students should expect to be in the lab beyond the normal working hours, i.e. evenings, weekends, and possibly over vacation days during the term. This commitment of time is especially important when long, complex experiments are being done. A major part of the mentor's rotational assessment (as well as their willingness to accept a student) will be based on the degree and quality of lab effort. Students should always discuss time off and/or vacation days with their lab mentor in advance, both in their lab rotations and once they enter a thesis lab.

Rotation talks: Near the end of the spring semester of the first year, students will give rotation talks. The format and scope of the talks will be communicated to the students by COGSA in the fall semester of the first year.

Teaching Requirements: Two semesters of teaching are required of all graduate students. Students usually fulfill this teaching requirement during their first year. Performance as a teaching assistant will be evaluated by the course supervisor in a letter that becomes part of the student's record.

Additional Teaching Experience: The Department offers several mechanisms to gain additional teaching experience; these include but are not be limited to: 1) additional teaching as TA; 2) working with the Biological Sciences Initiative Science Squad; 3) working as the lead TA for one academic year. These opportunities are available to students who have passed Comps and have the approval of their thesis committee. Additional TA assignments may be done on a space-available basis, and appointment to the Science Squad or as Lead TA requires application to the Biological Sciences Initiative program or the Graduate Teacher program, respectively. In all cases, COGSA reserves the right to prevent the students from taking on additional teaching in the interest of academic progress. These teaching opportunities must not interfere in any manner with the expeditious completion of the Ph.D. thesis. The thesis committee must make an assessment of progress to degree completion during the year of additional teaching.

Course Requirements: Students must complete the MCDB Core Curriculum plus elective courses numbered 5000 or above. The Graduate School requires that students maintain a 3.0 (B) average in all work attempted. For the Ph.D., a course grade of B- or below is unsatisfactory and will not count toward fulfilling requirements for the degree. Courses below the 5000 level do not count towards the PhD degree and are not be covered by funding.

MCDB Core Curriculum:
MCDB provides coursework tailored to provide all students with a basic knowledge in areas relevant to Molecular, Cell and Developmental Biology. Required courses are listed below.
MCDB 5230: Graduate Core (3 credits, fall of first year)
MCDB 5210: Cell Structure and Function (3 credits, spring of first year)
GRAD 5000: Responsible Conduct of Research (1 credit, offered annually)
MCDB 6000: Introduction to Laboratory Methods (9 credits for rotations/fall and spring of first year; 3 more credits the fall of second year-counted towards lab research
MCDB 6441: Faculty Research Seminar fall of first year (1 credit)
MCDB 6442: Scientific Writing fall of second year ((2 credits)
MCDB 7910: MMB seminar fall and semester of second year (2 credits total)
In addition to the core courses listed above, MCDB trainees are required to complete additional electives of their choosing in order to fulfill the required 30 credits of course work. Electives are flexible and generally reflect student interest or relevance to thesis lab training but must be at 5000 level or above and related to your research. In total, 30 credits of course work are required for graduation.

Thirty credits of doctoral thesis research are also required, no more than 10 of which can occur in 1 semester, and no more than ten of which can occur prior to the semester before the

comprehensive exam. Per Graduate School rules, students must register for at least one dissertation credit prior to taking the comprehensive exam.

Transferred Credit: An official Transfer of Credit Form must be submitted to the Graduate School after three semesters of residency but before application for candidacy for graduate-level courses taken at other universities are to be credited toward the Ph.D. degree. Transferred credits may not have been used toward a previously awarded degree**.**

Thesis Research: At the end of the second semester of year one, each student must select an advisor for thesis research, which requires mutual consent between the student and the advisor. The student must inform the chair of COGSA of their advisor selection, which must be approved by COGSA. Thesis research begins immediately thereafter. Only advisors with current grant support can accept a new graduate student. Students and prospective advisors may not make commitments to each other until after the official end of the semester.

A student is discouraged from performing thesis research in a lab in which they worked previously as a technician or performed research as an undergraduate at CU but may do so with COGSA's approval. In such a case, there will be continued oversight by the thesis committee to ensure that doctoral research provides a real learning opportunity for the student and not a mere continuation of prior research as an undergraduate or a technician. Students who performed summer research only at CU previously are exempt from this requirement.

In the event that a student is not accepted into her/his first four choices of laboratory, or for other good cause, COGSA will consider postponement of this decision until after an additional rotation in another lab during the subsequent summer. Ultimately, it is the student's responsibility to find a thesis lab; failure to do so will mean an exit from the program. Students may change thesis advisors at their initiative but should notify COGSA of this intent and consult with COGSA.

Training Programs: Following successful completion of first-year requirements and choice of a thesis advisor, students may request admission to one of three interdisciplinary training programs: Signal Transduction and Cell Regulation (STCR), Molecular Biophysics, and Cardiovascular Disease. Students admitted to these programs are eligible for financial support from the corresponding training grant, subject to availability of funds. Requirements for these programs differ from each other and from the standard MCDB program.

Employee Benefits and Work Expectations: While the University does not consider graduate students to be employees, some issues are best thought of in terms of employment:
-MCDB pays for student health insurance.
-Parental leave is six-weeks (30 working days) with pay (from whichever source is paying the student immediately prior to parental leave), and additional leave without pay as necessary (subject to change with respect to University policies including policies on Leave of Absence)
- Vacation is limited to three weeks (fifteen working days)/year with advisor approval. Vacation time does not include University holidays. Note that semester break, spring and fall breaks are not University holidays; these are features of the academic calendar affecting classes.
- Appointment as graduate student in MCDB is a twelve month/year position. The workload for this position is at least full-time and is necessary to finish a degree in a reasonable amount of time.

-Students may not “moonlight” by holding other positions, with the exception of limited tutoring with advisor approval. Moonlighting is expressly prohibited by NIH training grants and most other funding sources.

-The Department has endeavored to achieve equity in stipends such that every student gets the same stipend despite funding source. At present, students accepted in the Ph.D. program are provided full tuition, fees, health insurance, and a stipend per year for living expenses. There are a few exceptions, particularly some external fellowships that pay higher stipends than our current Departmental stipends. Students utilizing the additional teaching experiences will make the same stipend as their peers with the expectation that the workload will be different reflecting the teaching effort.

-Continued support is contingent upon satisfactory academic and research performance by the student. When a student enters a thesis lab, the thesis mentor assumes complete responsibility for the student’s stipend, tuition, fees, and associated research costs. **In order to qualify for in-state tuition for the following year, all out-of-state students must establish Colorado residency by the of summer of the first year or they will be responsible for any differences in tuition.**

ADVANCEMENT TO CANDIDACY

Advancement to candidacy for the Ph.D. degree requires a grade of B or greater in the Core Course and satisfactory completion of the Preliminary and Comprehensive Examinations.

Preliminary Examination: This exam, required by the Graduate School, is administered as a series of exams within the Core Course in the first year. It is required that students pass the course (as measured by the exams) with a grade of B or greater. Unsatisfactory performance on this exam (B- or lower) will generally lead to termination of graduate studies unless COGSA recommends remedial action and a chance to retake the exam. Upon passing the Preliminary Exam, students can begin their research work.

Comprehensive Examination: To advance to candidacy for the Ph.D., students must pass a Comprehensive Examination by the end of the second year. The exam is administered by a Comprehensive Exam Committee composed of four MCDB faculty members chosen by the exam committee, and one selected by the student and approved by the exam committee. The student’s thesis advisor is not permitted to participate directly in the exam. The exam has a written and oral component.

The written portion involves preparation of a research proposal in the format of a predoctoral NIH F31 grant application on a topic of the student’s choosing, which may include the student’s current thesis project. The details of the requirement for the written proposal will be available to students at least three months prior to the date of the exam. The proposal must be submitted to the examining committee at least forty-five days prior to the announced date of the oral exam. The examining committee is required to review the proposal within two weeks and deem it acceptable or provide specific editorial comments that would allow the student to revise the written proposal such that it is acceptable. Readers of the exam must communicate with each other prior to returning the exam to the student for revision to assure a consistent opinion. At the end of the revision process, and at least one week prior to the oral exam date, the written exam must be deemed either acceptable or unacceptable. If unacceptable, the examining committee has the right to extend the time for preparation or to terminate the student in the program.

The oral exams for all students will be administered over a one-week period at the beginning of the spring semester of the second year. Generally, each exam will begin with a brief presentation of the written proposal by the student and will include no more than four slides. Subsequent discussion will be roughly based on the written exam but is not restricted to it. The committee is charged with exploring the student's knowledge of related areas and topics of major importance to the proposed work as well as the ability of the student to integrate and interpret data in areas deemed important for the MCDB training program. Dates, specific guidelines, and other details for each year's exam will be provided by the Comprehensive Exam Committee.

Each student will receive written notification of the exam results within a week of the last exam. Evaluation criteria will be described in detail in a meeting between students and the Exam Committee prior to the exam. A sample of the current grading rubric may be found here: https://www.colorado.edu/mcdb/sites/default/files/attached-files/comprehensive_exam_evaluation_sheet.pdf
As part of the final evaluation report, students will be provided a detailed statement sheet describing their performance in each of several clearly identified categories. The only possible outcomes are satisfactory or unsatisfactory. Students receiving an unsatisfactory evaluation must meet with the committee to discuss the reasons for the evaluation and, if deemed appropriate, the student will be offered the opportunity to retake the exam before the start of the fall semester. Examination Committee members are obliged to be available for discussion regarding deficiencies and expectations for the re-examination. The Graduate School allows all students two, and only two, attempts to pass the comprehensive exam.

Thesis Committee: Following successful completion of the Core Course and Preliminary Exam, the student selects a thesis committee composed of three members of the MCDB faculty who are also members of the Graduate Faculty; one of the three members is the advisor, and a member of the committee other than the advisor serves as Chair. In the Fall semester of the second year, the student should meet with the committee to discuss thesis proposal ideas as well as future coursework. Thereafter, thesis committee meetings must occur bi-annually (at a minimum). By the end of the fourth year, the student must appoint a fourth committee member, and by the time of defense, a fifth member must be appointed. The appointment of the fourth and the fifth members may occur earlier at the discretion of the student and the thesis advisor. At the time of defense, at least one member of the committee must hold an academic faculty position outside of MCDB. The student must notify the Graduate Coordinator of any intended change in the committee or thesis lab. All changes in thesis committee rosters require approval by COGSA**.**

Admission to Candidacy: A written application for admission to candidacy for the Ph.D. degree must be submitted during the second year according to Graduate School rules. To meet this deadline, the student must send the list of their Comprehensive Exam Committee members and the name of the Committee Chair to the Graduate Coordinator at least three weeks before the exam date. Upon approval by the Comprehensive Exam Committee, the student is admitted to Ph.D. candidacy, provided that all other Graduate School requirements are met, which include at least four semesters of residency excluding summers.

After admission to candidacy the student must maintain continuous enrollment, for at least five Doctoral Dissertation credits per semester, until completion of the dissertation defense. Students not making use of campus facilities, or are attending part-time may petition for three credit status.

ADVANCEMENT TO THE Ph.D. DEGREE

Yearly Evaluation: Starting in the fall semester of the second year, students are expected to present a departmental talk each year in the departmental research seminar**,** Mostly Molecular Biology (MMB). The Departmental Graduate Coordinator and COGSA create the MMB schedule. It is expected that all Faculty attend MMB. Shortly after this presentation, a thesis committee meeting is convened in order for the student to gain scientific and practical suggestions. Following the meeting, the Chair of the Thesis Committee submits a brief report to the Graduate Office Coordinator, with copies to the thesis advisor and the student, indicating that the committee has met and that progress is either satisfactory or unsatisfactory, noting specific problems and/or suggestions and stating goals for the next year. It is the Chair's responsibility to see that this statement is submitted.

On a yearly basis, COGSA will determine, based primarily on committee reports, whether a student's performance has been satisfactory or unsatisfactory. In cases where the student's performance has been unsatisfactory, COGSA, in consultation with the student and the thesis committee, will define a plan to remedy the problem. Continued unsatisfactory performance is grounds for asking a student to leave the graduate program.

Time Limit: Students in MCDB should be able to complete the Ph.D. program in approximately five years. However, under Graduate School rules, doctoral students have six years from date of matriculation in the program to complete all requirements, including filing of the dissertation with the Graduate School. If a student has not completed the Ph.D. in six years, the Graduate School notifies the student and the Department during the first semester of the seventh year that the student must finish their degree during that semester or get an extension by petitioning the Graduate School. The petition requires support from the thesis advisor and COGSA. COGSA will support such a petition only with good cause. The petition must include a detailed plan including a schedule for the completion of the Ph.D. thesis. The student develops this plan in consultation with and approval by the advisor and thesis committee before the plan is sent to COGSA for approval. COGSA, if it approves the plan, will support the student's petition to the Graduate School for an extension**.** A sixth year student may initiate the petition for an extension prior to the beginning of the seventh year. This will allow processing and Graduate School approval prior to the semester. The form is electronic and can be found on the Graduate School website.

Ph.D. Thesis: The doctoral thesis is based upon original research approved and supervised by a member of the Graduate Faculty, which includes MCDB faculty members. The thesis must meet the general requirements of the Graduate School and is usually judged by the standards used to evaluate research for publication in a leading professional journal in the student's area of specialty. To be granted a Ph.D. degree, students must, at a minimum, have a first-author or co-first-author paper describing their research "in press" or published. If a student feels there are extenuating circumstances that make this impossible, the thesis committee and COGSA may be petitioned to relax or waive this requirement. Students are strongly encouraged to publish their work prior to their thesis defense. The Graduate School has rules and deadlines that must be followed for submission of a thesis and scheduling of the final thesis defense. (See the University Catalog or consult with the Student Affairs Office).

Departmental Timetable for the Final Year: At least six months in advance of planned departure, the student must meet with the thesis committee for a review of progress toward completion of the thesis. At this 'six-month' meeting, the student must provide a detailed outline for the proposed thesis, indicating which portions of the research are completed and which remain to be done. If the committee does not already include a member from outside MCDB, plans should be made at this time to recruit an outside reader to be included in all activities of the committee until the final acceptance of the thesis; the outside reader must be a member of the graduate faculty of the University (temporary appointments may be made for other qualified individuals). At the six-month meeting, the committee may also wish to discuss expectations about the format and timing of the final defense. To qualify for consideration of graduation in a given semester and ensure adequate time for revisions, the student must submit the thesis to the committee no less than one month in advance of the University thesis deadline for graduation and three weeks in advance of the planned date for the oral defense. The Graduate Student Office should be notified when the complete thesis is circulated so the office can track the progress of the defense and aid the student in scheduling the defense**.** Within two weeks after receiving it, the committee will approve the content and format of the thesis as adequate for proceeding with the oral defense and/or notify the student of any revisions required. Final scheduling of the oral defense requires approval of the committee.

The oral defense (Final Examination) includes presentation of a public seminar on the thesis research, followed immediately by a meeting between the student and their thesis committee. Other members of the Faculty may attend this meeting. The student must send the title and the abstract of the thesis to the Graduate Coordinator approximately one month before the oral defense so that public announcements may be posted. During the oral defense, the candidate may be questioned about the thesis and about areas of science related to the thesis. A successful thesis defense requires the affirmative vote of at least four of the five committee members. After the thesis defense, the student will alert the Graduate Coordinator so that the proper forms can be submitted to the Graduate School.

OVERVIEW OF YEARLY ACTIVITIES

1ST YEAR

Registration:

Graduate core (fall)
Cell Structure and Function (spring)
Rotation research (both semesters)
Faculty Research Seminars (fall)

Preliminary exams: administered within the Core Courses (fall and spring)
Rotations: 2 rotations per semester, rotation talks at the end of the spring semester
Teaching: Teaching assistantships, both semesters
Thesis research: the choice of thesis lab is made late in the spring semester
Summer: Students are not required to register for classes during the summer term unless they are defending over the summer break.

2nd YEAR

Registration:

Scientific writing (fall)

Responsible Conduct of Research (fall)
Thesis research, using the same code as rotation research (fall)
Doctoral Dissertation research (spring)
MMB (1 credit each for fall and spring semesters)

MMB: presentation according to schedule set by the department
Thesis research: form thesis committee and have first meeting after the MMB
Application to candidacy: must be completed before the Comprehensive exam; students send the name of their Comps examiners and Chair to Graduate Coordinator 3 weeks before the exam
Comprehensive exams: spring semester

3rd YEAR & LATER

Registration:
Thesis research
Electives
MMB: as scheduled

STUDENT FEEDBACK AND GRIEVANCES

COGSA seeks student input and encourages student participation in Departmental functions (see below). Students are encouraged to speak with members of COGSA at any time for advice concerning the Graduate Program. The COGSA Chair attends an annual student meeting to seek input from the students and convey information about the graduate program. The COGSA Chair also meets with the first-year students to answer questions and provide advising. COGSA should be notified of any student grievance and will endeavor to resolve the issue. If the issue is not resolved at this level, COGSA will refer the student to the Department Chair or the appropriate campus office. The latter include offices to deal with sexual harassment, minority issues, scientific misconduct, financial conflicts of interest, and disabilities. While students are strongly encouraged to solve problems within the Department, students who want to resolve an issue outside of the Departmental structure should contact the OMBUDS Office at 492-5077.

STUDENT PARTICIPATION ON COMMITTEES:

Graduate students serve on several important committees as advisors or voting members. Students are elected to these positions for a one-year terms by the MCDB graduate student body at a meeting held every fall soon after the beginning of the academic year. Students are encouraged to invite one to two seminar speakers a year, and the mechanism to do this should be worked out at the Fall student meeting. Graduate student positions include:

Equity and Justice Committee: This committee consists of faculty members, staff members, and graduate students. The committee was formed with the recognition that while MCDB desires to create a welcoming environment for all, we still have a long way to go to increase diversity throughout our department. E&J Committee identifies areas for improvement and makes recommendations to the Chair on possible actions that can be taken.

Committee on Graduate Student Affairs (COGSA): COGSA consists of five faculty members, the Graduate Coordinator, and one graduate student. The responsibilities of COGSA are: to propose and implement changes to the graduate curriculum; approve lab rotations; to

evaluate and recommend changes to the doctoral degree requirements to the faculty; to oversee the graduate program. The student member has voting rights equal to the other members of COGSA, except on decisions concerning specific graduate students or graduate student salaries/ stipends.

Graduate Admissions Committee: This committee chooses the members of the incoming graduate class from the pool of applicants and includes: 5 faculty members, 5 graduate students, and the Graduate Coordinator. The committee also makes recommendations on changes in recruitment policy and is responsible for organizing and running graduate student recruitment weekend activities.

Graduate Student Symposium Committee (GSSC): This committee organizes the MCDB graduate student symposium. Approximately one year before the symposium, the graduate students select a topic and form the committee. The committee organizes the symposium, with advice from COGSA, the departmental chairperson, and the faculty.

Faculty Representatives: One student attends faculty meetings as an observer to offer student viewpoints and report to students on faculty decisions and pending decisions.

UGGS Representative: One MCDB graduate student representative attends the campus-wide United Government of Graduate Students (UGGS) meetings and also serves as leader of the MCDB graduate students, calling departmental graduate student meetings as needed (including the Fall meeting).