

Genome, Cell, and Developmental Biology (GCDB) Graduate Program

Overview: Welcome to the Genome, Cell and Developmental (GCDB) Program within the Biology Department at Indiana University! The GCDB interdisciplinary graduate program provides classroom and laboratory training in key areas of genetics, genomics, cell biology, developmental biology, molecular biology, biochemistry, biology, cell biology, bioinformatics, and evolution. Students in our program learn how to plan, execute, critically analyze, and communicate scientific research. Professional development includes learning how to present seminars and write high-quality research papers and grants. The GCDB program provides students with research training and professional development to pursue careers in academic biomedical research, biotech industry, university-level teaching, and other life science careers.

Doctor of Philosophy (Ph.D.) Degree Requirements

This handbook, other information, and required forms for the GCDB program can be found in the GCDB folder on the cloud-sharing platform “IU Box.” Many of the forms that are required by the Graduate School are now submitted and routed through the electronic system on “One IU.” Another important resource is the Graduate School website: <http://graduate.indiana.edu/>. That site contains information about forms and rules for graduate students, the written Ph.D. thesis, and thesis defense seminar. It also has a .pdf of the official Graduate School Bulletin, which contains more detailed information about the general requirements of the Graduate School and the specific requirements of each program. See the end of this document for links to other useful web sites.

Degree Information: Students entering our program are expected to earn a major in Genome, Cell and Developmental Biology and a minor in a subject area that is of interest to the individual student and related to their thesis project. Most students choose the Genetics minor offered by GCDB, but other minors are possible.

Teaching Requirement: Ph.D. candidates within the GCDB graduate program are required to teach for at least one semester during their graduate career. To prepare graduate students for their teaching assignments, the Department of Biology offers a Teacher Training Workshop. All graduate students must enroll in this workshop prior to the onset of your first teaching assignment; however, we strongly suggest that students complete this workshop during orientation week prior to the start of your first year in graduate school. In addition, all graduate students must enroll within the Associate Instructor Workshop on Campus Climate, which is offered by Indiana University, also offered during orientation week.

English Proficiency Exam: Students whose native language is not English must pass the Test of English Proficiency for Associate Instructor Candidates (TEPAIC), an English fluency examination. If the TEPAIC has not been passed at the time of entry into the program, students must take a formal course in English fluency (T502) in their first semester. Further information about this course is available in the Graduate Office. Students must pass the TEPAIC by the end of the fall semester of the first year in order to guarantee further support.

Plagiarism Tutorial: During orientation week, all first year GCDB graduate students must complete an online tutorial on plagiarism and submit a confirmation certificate to the Biology Graduate Office. The online tutorial can be found at the following website: <https://www.indiana.edu/~academy/firstPrinciples/index.html> Note that violation of the plagiarism rules is a serious infraction and can result in dismissal from the program and graduate school.

General Course Requirements: A total of 90 credit hours are required for partial fulfillment of the Ph.D. degree. Of these, 21 credits are earned by completing the course requirements for the GCDB major. An additional 6-12 credits are earned by completing the requirements for the minor, depending on type of minor. All remaining credits are earned through laboratory research rotations (first semester) and enrollment in L800, independent thesis research. A listing of courses for which graduate credit is offered can be obtained from the Biology Graduate Office or from the Indiana University Office of the Registrar website <http://registrar.indiana.edu/>.

Course Requirement for the GCDB Major¹

First Year Fall

BIOC-B 511	Duplicating and Expressing the Genome	3.0 cr
BIOL-L 585	Genetics and Bioinformatics	3.0 cr
BIOL-Z 620	Bioinformatics-2-Go	1.5 cr
BIOL-L 523	Critical Analysis of the Literature	1.5 cr
L501	Rotations	3.0 cr

First Year Spring

BIOL-L 586	Cell Biology	3.0 cr
BIOL-L 587	Developmental Biology	3.0 cr

Second Year Fall

BIOL-Z 620	Grant Writing	1.5 cr
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Third Year Spring

BIOL-Z 620	Res Ethics and Career Dev.	1.5 cr
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Total **21 cr**

Students should register for additional minor courses and/or independent research (L800) to total 12 credits each semester.

2020 Covid-specific amendment: Incoming graduate students who start in Spring 2020 will enroll in BIOL-L586, BIOL-L587, and BIOL-L501. The coursework required during their second year will be determined by the GCDB Graduate Program Director upon arrival in Spring 2020.

Students can register for 0-6 credits during the summer, but should first consult with their mentor and the Biology Graduate Office.

¹The GCDB Graduate Program Director must approve any exemptions or substitutions of listed classes with equivalent courses. Exemptions / substitutions also require official approval from the Graduate School. These exemptions / substitutions are rare.

G901 Status: Once 90 credits are earned, students are in "G901 status." Once this status is achieved, the tuition costs and fees charged by the college drop dramatically. G901 status is typically attained during the 4th year. Students then register for six G901 credits each semester instead of L800 research credits, but students cannot register for any more formal coursework. Students can use G901 status for six semesters, after which they lose G901 status and full tuition is charged again, even if 100% of their time is engaged in laboratory research.

2020 Covid-specific amendment: Students who were enrolled as graduate students during the Spring 2020 semester are eligible to register for two additional G901 semesters. The paperwork for requesting additional G901 semesters should be filed during the fifth semester of G901 enrollment.

Course Requirement for Minor: Indiana University requires that all graduate students obtain a minor. Ph.D. candidates must declare a minor by the end of the fall semester of the second year; however, we encourage students to declare a minor by the end of the first year so that minor coursework can begin in the second year. The GCDB program offers a six-credit minor in Genetics. An approved list of courses for the Genetics minor can be found by entering the “student portal” on the GCDB program website <https://biology.indiana.edu/student-portal/graduate/index.html>. Students wishing to use courses for the minor that are not on this list must get advanced approval from the GCDB Graduate Program Director and the Graduate School. Important: a course that is used to fulfill the minor requirement cannot count towards the major requirement and vice versa.

Information relating to the course requirements for minor degrees outside of the GCDB program can be obtained from the program director of the relevant graduate program. GCDB graduate students must obtain approval for minor degrees outside of Genetics from their thesis advisor, thesis committee, and the GCDB Graduate Program Director. All course requirements for the minor degree must be completed by the end of the spring semester of the third year.

Attendance at GCDB Program Seminars: All Ph.D. candidates are required to attend the weekly Thursday GCDB seminar series throughout their entire career within the program. These seminars are an opportunity to hear about the latest research from prominent invited scientists, and are an *integral* part of a diversified scientific training program. The seminars are held Thursday afternoons at 4pm during the fall and spring semesters. A complete listing of the invited speakers is available on the Biology Department website. They are also announced via “This Week in Biology” emails, an important email to read.

GCDB Trainee Research Seminars: During these seminars, two GCDB graduate students or post-docs will present their research. These seminars are held on the first Thursday of every month at the regular seminar time of 4 p.m. All GCDB students are required to present in this seminar series at least twice during their graduate work, and beginning no later than their 4th year in the program. All GCDB students who are not presenting that week are required to attend.

Community Participation: GCDB graduate students are also expected to attend the public portion of the thesis defenses of their fellow GCDB graduate student colleagues, and other special lectures including the Carlos O. Miller Lecture, the James P. Holland Lecture, the Tracey M. Sonneborn Lecture, the Muller Lecture, tenure and promotion seminars by GCDB faculty, and GCDB job candidate seminars. The dates and times of these seminars can be found on the Biology Department website. In short, attendance at these events is part of graduate scientific and professional development and important for GCDB community cohesion.

Publications: To earn a Ph.D., your research must make a significant contribution to your field. By definition, a significant contribution requires that you publish your thesis research. Ph.D. students within the GCDB program are expected to publish at least two, significant, peer-reviewed papers prior to the thesis committee approving the student for graduation. Rare exceptions to this expectation must be approved by the thesis committee and GCDB Graduate Program Director.

Research Rotations: Each Ph.D. candidate is required to complete three research rotations (L501) during the fall semester of the first year. Students may rotate with GCDB core and affiliated training faculty. A complete listing of these faculty can be found on the GCDB program section of the Department of Biology website: <https://biology.indiana.edu/graduate/genome-cell-development/faculty/index.html> In addition to their departmental web pages, many GCDB faculty members have lab web pages that are linked to their departmental page. During orientation week, GCDB faculty will give short talks to new students to help them select a rotation lab. In addition, any GCDB student can rotate and do their Ph.D. research with any approved graduate training faculty within the Department of Biology. Students are *highly* encouraged to contact and meet individually with faculty members to learn more about their research before selecting a rotation lab. The GCDB Graduate Program Director will go over the rotation timeline document and instructions for selecting a laboratory with incoming students during orientation week.

2020 Covid-specific amendment: All students will participate in research rotations during the first year. Students enrolled in both the Fall 2020 and Spring 2021 semesters will complete 5 research rotations. Students arriving in January 2021 will complete 3 research rotations. These requirements may change as the result of unexpected university closures.

2020 Covid-specific amendment: All students participating in research rotations must follow Indiana University Covid-19 Safety Policies.

At the end of each rotation, the research supervisor must complete the “**Rotation Evaluation**” form and discuss it with the student. The faculty member and student must both sign the form, and then the student brings the form to Jason Tennesen, the GCDB graduate program director. This form can be downloaded from the GCDB Grad Program Folder on IU box. Based on the three rotation evaluations, a final grade will be assigned for L501.

2020 Covid-specific amendment: Students enrolled in the Fall 2020 semester will receive a L501 grade based on the Fall semester rotation evaluations. Students arriving in January 2021 will receive a L501 grade based on the Spring semester rotation evaluations.

At the end of the third rotation in December, Ph.D. candidates are required to select a laboratory within which they will conduct their thesis research. In the rare case that students wish to do a 4th rotation, they must obtain permission from the GCDB Graduate Program Director. The selection of a thesis home is a negotiation process between the faculty and student. Students are not guaranteed positions in laboratories, although in practice this is rarely an issue. It is important to note that entry into a research lab is a requirement for our graduate program, and students must have joined a lab by the end of the spring semester of the first year, at the very latest, to remain in good standing.

2020 Covid-specific amendment: Students will be assigned a lab following the final rotation of the Spring 2021 semester. Additional rotations during Summer 2021 requires permission from the GCDB Graduate Program Director.

Thesis Committee: At the end of the spring semester of the first year, students will need to select a Thesis Advisory Committee. The final committee must include the thesis advisor and at least three other faculty members, for a total of four members. The student has the option to recruit two faculty members at the end of the first year, with a third added no later than the end

of the fall semester of the second year – who could be the minor representative. The committee members should be selected based on their ability to contribute to the student's thesis project, and do not necessarily have to be members of the GCDB section. The student should fill out an electronic "**Appointment of Advisory Committee**" form. The form can be found on the College's website: <https://college.indiana.edu/student-portal/graduate-students/academic-procedures/index.html>

Annual Committee Meetings: Students must have their first thesis committee meeting no later than the end of the fall semester of second year. Ph.D. candidates are *required* to formally meet with their thesis advisory committee once a year. The meeting is designed to assess the progress of the student in the past year and to provide advice on the upcoming year's experiments. Prior to meeting with the committee, the student should provide a written document summarizing progress over the past year and the experiments that are proposed for the upcoming year. Please see the "**Thesis Committee Meetings and Report Guidelines**" on IU box for how to schedule a meeting and the format of this report. The report should be distributed to all committee members no later than one week prior to the annual meeting. The student is responsible for filling out the first page and emailing the "**Committee Meeting Evaluation**" form to their committee. After the meeting, this electronic form is completed by the committee, signed, and emailed to student, committee members, and Mary White Wolf in the Graduate Office. The student and advisor should discuss the contents of that form after the meeting and prior to its submission.

2020 Covid-specific amendment: All committee meetings must be conducted by zoom. The committee chair should schedule a secure meeting and send links to all participants. The student should NOT setup the zoom meeting due to privacy concerns.

Individual Development Plans (IDPs): In addition to their thesis report, each year the student should update a GCDB IDP form in consultation with their mentor and then email it to the committee with their thesis report. This IDP form can be found in the GCDB program folder on IU box. An IDP is a useful tool that helps students plan activities, develop skills, and set milestones as they prepare for their future career. It is also a vehicle for the student to have substantive career advising discussions with their mentor and thesis committee members. Please see further instructions on the IDP form.

Preliminary Exam Requirement: All Ph.D. candidates in the GCDB graduate program are required to take the Preliminary Exam, no later than the end of the 7th week of the Fall semester of their 3rd year. Students write a proposal on their thesis research and then defend it orally. During the oral exam, students are also examined for general knowledge relevant to their research area. The GCDB Graduate Program Director will meet with all second-year students in the spring semester to discuss the preliminary exam format and instructions.

The Preliminary Exam Committee will normally consist of the members of the thesis committee (minus the thesis advisor), or other members selected by the GCDB program director. After the examination an electronic "**Preliminary Exam Evaluation**" form must be completed and signed by the committee, advisor, and student. The form is then emailed to the GCDB program director, who signs it and sends it to the graduate office and the Biology Director of Graduate Studies.

If the committee is satisfied with the student's performance on the written and oral exam, then the student passes. If the members of the committee feel that the student's performance does not warrant a passing grade, then they can either fail the student or provide the student with the opportunity to retake one or more portions of the exam. If the second option

is selected, the student must successfully complete the required items by the end of the fall semester of the third year. If a student does not pass the preliminary exam by this date, they may not continue in the Ph.D. program. On a case-by-case basis, a student may be admitted to a program leading to a Master's Degree in GCDB. Depending upon the circumstances, the thesis committee (in consultation with the GCDB graduate program director) can recommend that the student be enrolled in either a research or library Master's program. See the "**Preliminary Examination Format**" document on IU box for more information.

2020 Covid-specific amendment: All preliminary exams must be conducted by zoom. The committee chair should schedule a secure meeting and send links to all participants. The student should NOT setup the zoom meeting due to privacy concerns.

Nomination to Ph.D. candidacy: After passing the preliminary exam, and fulfilling all major and minor requirements, the student moves on to Ph.D. candidacy. The student must complete the "**Nomination to Candidacy**" form that is located on their personal One.IU site. This form is then submitted electronically to the Biology Graduate office. A list of courses that were taken to meet the major and minor requirements should be submitted with the Candidacy form. Completion of major and minor courses and submission of the candidacy form should be at the end of the third year.

Thesis Requirement: Submission of a written thesis to Indiana University is required for a Ph.D. degree. The graduate school calls these "dissertations" for Ph.D. students. The thesis / dissertation must represent a body of independent, published work that makes a significant contribution to science. Once the student and advisor agree that the thesis research is nearly done, a student should begin to plan the thesis defense. *At least* six months in advance of the defense, the members of the Thesis Advisory Committee and the University Graduate School must approve the thesis prospectus. The student should provide the committee with an updated CV, copies of manuscripts that have been published, accepted, or are in a state of revision, and a detailed outline of the thesis. The student should also meet with the committee and present in seminar format the completed and anticipated research progress. The student should then select a date for the defense when all of the thesis committee members can be present.

Instructions on the proper thesis format are available at: <https://graduate.indiana.edu/thesis-dissertation/formatting/doctoral.html> and hard copies of theses of former students are available in the Biology Graduate Office. Each thesis committee member must receive a copy of the thesis. This version of the thesis must be considered complete by both the student and advisor, including all figures, tables and references. The thesis must be submitted to the committee no later than **four weeks prior to the defense**. Committee members are expected to read the thesis promptly and carefully. If they have major objections, they will express them at this stage and the defense may be postponed. It is more common that committee members will suggest revision of only portions of the thesis, and will reserve these comments for the thesis defense.

The thesis defense comprises two parts: a public presentation followed by a private exam by the Thesis Advisory Committee. The public presentation (i.e. a seminar) must be announced in advance: the University Graduate School requires the submission of an Announcement (electronic) page, which can be found at: <https://graduate.indiana.edu/thesis-dissertation/> This one-page summary should be submitted 40 days prior to the scheduled defense (to allow time for processing to meet the 30 day Grad School deadline). The student is also required to post a seminar announcement in the Biology Department "This Week in Biology." After the exam, the thesis may be accepted in their current form (rare), rejected (also rare), or accepted pending

revision (common). Once a thesis has been revised to meet the committee's standards and the University's format requirements, the committee and research advisor certify its acceptance to the Graduate School and recommend that the Ph.D. degree be awarded. It should be noted that the thesis must be accepted formally no later than 7 years from the date of admission to candidacy (successful passing of the preliminary exam). In most cases, however, it is expected that it will take much less time for a student to publish their research and defend their Ph.D.

Academic Standing: For all graduate degrees, students must maintain a minimum GPA of B (3.0) in order to remain in good standing in the Graduate School. Courses to be counted toward the degree must be passed with a grade of B- (2.7) or better. To be eligible for financial support, the Department of Biology requires students to maintain a minimum GPA of 3.2. A student who has a GPA of less than 3.0 will be placed on academic probation. The student will then have one semester in which to correct the academic deficiency. Under extreme circumstances, this period can be extended but requires approval of the GCDB graduate program director. If the student is able to rectify the situation then the academic probation will be lifted. If the situation persists, then the student will be required to leave the program.

In addition to meeting all University individual course and semester grade requirements, a student must be making sufficient progress in their research and effective teaching in order to remain in "good standing" within the GCDB program. If the research advisor and/or other members of the Thesis Advisory Committee become dissatisfied with a student's progress or efforts, a meeting of the student with the Thesis Advisory Committee must be called to discuss the reason(s) for concern. If the Committee determines that the student's progress is not satisfactory, then the student will be placed on probation. The probationary period of ~ one semester will provide an opportunity for the student to demonstrate effectiveness and progress in research. This research may be conducted in the same lab with the same research advisor or in a new lab with a different research advisor. If the Thesis Advisory Committee judges the student's progress to be satisfactory at the end of the probation period, probation will be lifted. If the Thesis Advisory Committee judges the student's progress to remain unsatisfactory, then the student will be required to leave the GCDB program and any departmental commitment to provide further financial support for the student will be suspended at the end of the semester during which the student is discharged from the program.

General Outline of Graduate Career in the GCDB Program

Note that the following outline could change in response to the ongoing Covid-19 pandemic. See Covid-related amendments listed above.

First Year

Important goals of the first year include successfully completing required coursework, selecting a research lab, beginning thesis research, and selecting a thesis advisory committee.

Fall: Students conduct three research rotations and then select a thesis research lab by the end of the fall semester. Students also enroll in a set of core courses that cover topics essential to molecular biology, cell biology, developmental biology, genomics, and genetics. Please see the “Course Requirements for Major” list for details.

Spring / Summer: Students begin their thesis research and continue to take required courses. In rare cases, and with approval by the GCDB program director, students may do a 4th rotation that extends into the second half of the year. By the end of the spring semester each student must assemble a thesis committee to help oversee their progress toward the Ph.D.. All rotations, the selection of a thesis advisor, and the assembly of a thesis committee must be completed by the end of the spring semester of the first year. At the end of spring semester, students assemble a thesis advisory committee and submit an “**Appointment of Advisory Committee**” form. During the summer, students focus on making significant research progress. Another important summer goal is to write the first draft of the thesis research proposal in preparation for the Grant Writing course and their first thesis meeting in the fall.

Second year

The second year of graduate school is primarily focused on becoming fully immersed in thesis research, preparing for the preliminary examination, and completing required coursework for the major and minor degrees. A student should continue to strive to become increasingly adept at reading the scientific literature and directing their own research – important goals of graduate training.

Fall: In addition to the Grant Writing course and minor course work, students must meet with their thesis advisory committee before the end of the fall semester. There are also a number of external graduate fellowship deadlines in the fall to which students should apply. Information about these fellowships can be found online in the GCDB folder and will be discussed in the Grant Writing course. The thesis proposal that students began writing during the previous summer should be a good first draft for these external proposals.

Spring / Summer: At the end of the spring semester, the GCDB program director will meet with all second-year students to discuss the upcoming preliminary examination that will take place in the fall semester of the third year.

Third year: The important goals of the third year of graduate school are the preliminary examination, completing all major and minor coursework, and transitioning to full-time research.

Fall: As described above, students must take the preliminary examination during the first seven weeks of the fall semester. This examination seeks to determine whether each student has successfully prepared for a career as an independent scientist. Students who pass the exam and complete all coursework are eligible for formal candidacy for the Ph.D. degree. Once

admitted to candidacy, students spend the majority of their time working on their research projects. Students who fail this exam will leave the program.

Spring / Summer: All students are required to complete a course in research ethics in the spring of their third year. The student must also submit an electronic **Nomination to Candidacy** form and then the graduate office will formally nominate them for candidacy if they have fulfilled all requirements. To be admitted to candidacy, all coursework for minor and major must be completed as well as passing the preliminary exam.

Fourth and Fifth Years: During the fourth and fifth years of graduate school all students are expected to devote 100% of their time and efforts towards completion of their thesis research. Students who are serving as associate instructors must budget extra time for their thesis research. Students *must* meet with their thesis committees once a year to remain in good standing. During this time, students must also present twice in the GCDB trainee series. Each Ph.D. candidate should be working towards publishing manuscripts and writing and defending their thesis at the end of their fifth year. The GCDB program expects that all students publish two peer-reviewed primary research articles. Given the inherent uncertainties of research, it is not uncommon for a graduate career to extend somewhat beyond the fifth year. Students should, however, exert significant effort to ensure that their career in graduate school is as short and productive as possible. By the end of the fourth year you must submit the **Nomination of Research Committee** form, which is required by the University Graduate School. This form is located on the One.IU site. This form formalizes your thesis title, provides a brief prospectus of your research, and solidifies your research committee. You must submit this form prior to advancing to your defense.

Contact Information: The following individuals will serve as your primary contacts for information about the GCDB graduate program.

Jason M Tennessen Ph.D.
GCDB Graduate Program Director
Jordan Hall, Room 343B
jtenness@indiana.edu
812.855.9803

Tuli Mukhopadhyay Ph.D.
Director of Graduate Studies
Simon Hall, Room 220C
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812.856.3686

Katie LaPadula
Graduate Student Service Specialist
Myers Hall, Room 150
klapadul@iu.edu
812.856.5522

Helpful Websites

IU Box GCDB folder: https://iu.app.box.com/files/0/f/5167935550/GCDB_GRAD_Program
Indiana University, Bloomington: <http://www.iub.edu>
Biology Department: <http://www.bio.indiana.edu>
GCDB Program: <https://biology.indiana.edu/graduate/genome-cell-development/index.html>
Graduate Awards: <https://biology.indiana.edu/graduate/awards-scholarships.html>
Lectures and Seminars: <https://biology.indiana.edu/news-events/index.html>
Indiana University Graduate School (University Bulletin): <http://graduate.indiana.edu>
College of Arts and Sciences: <https://college.indiana.edu/>
Teaching Resources for AIs: <https://citl.indiana.edu/programs/ai-support/>