Microbiology Graduate Program 2024-5

Contents

Introduction

Contact Information:

Sam Allen
Asst. Director of Grad Studies
MY150
812-855-2785
saiallen@iu.edu

James 'Jake' McKinlay
Micro Program Director
BB 447E
812-855-0359
jmckinla@iu.edu

Heather Reynolds
Director of Grad Studies
BB 155A
812-855-0792
hlreynol@iu.edu

Overview. Welcome to the Microbiology Graduate Program! You have chosen to be a microbiologist during an exciting revolution in microbial biology. This program provides training in the microbiology of prokaryotes, eukaryotes, and viruses. Students develop competencies in analytical and critical thinking, problem solving, resourcefulness, adaptability, creativity, collaboration, leadership, digital literacy, ethics, and oral and written communication. Competencies are developed as students learn to critically analyze and plan scientific research, present seminars, write high-quality research papers and proposals, and through coursework and seminars. Our program provides training and research experience necessary to pursue a range of careers in academia, biomedical research, the biotech industry, government science, and university-level teaching. The program takes place amidst a vibrant community of collegial colleagues that are committed to a diverse and inclusive culture of respect and kindness.

Forms and other information.

Most forms and info related to your graduate career, including the latest version of this handbook, can be found in the Biology Graduate Student Portal. Other helpful documents, like lab culture statements and career development articles, can be found in the shared Micro OneDrive folder. Appendices to this handbook contain requirements, protocols, and mentoring guidelines. Good mentoring is a critical component of graduate success. See Appendix M and R for the College's guidelines for advisor-graduate student interactions and a summary on where mentoring information can be found.

Degree Options: Overview

This handbook pertains to a Ph.D. in Microbiology. A summary of programmatic requirements for a Microbiology Ph.D. is in Appendix A. A Masters degree option is available on a case-by-case basis for students exiting the Ph.D. program (Appendix O). More details on the requirements for a Ph.D., Masters, and Minors from the Department of Biology can be found at the UGS graduate bulletin.

Course Requirements

Required credit hours and distribution. The Microbiology program requires 90 credit hours. Of these, **22.5 credit hours** (21 credits if the Responsible Conduct of Research workshop is taken to fulfill the Ethics requirement) come from the core course work, indicated below. Other appropriate courses may be substituted with permission from the Advisory Committee and the Microbiology Graduate Program Director (GPD). Any changes described here to course requirements can, but do not have to, apply retroactively. Course descriptions can be found at iGPS. The definition of a credit hour can be found here.

Core courses for the Microbiology Major and timing.

First Year Fall

BIOL-M 500	ROTATIONS (Introduction to Research)	(3.0 cr)
BIOL-L 523	Critical analysis of the scientific literature	(1.5 cr)

First Year Spring

*BIOL-M 511	Molecular Biology of Prokaryotes	(3.0 cr)
*BIOL-M 541	Virology and host responses	(3.0 cr)
*BIOL-M 585	Microbial Genetics and pathogenesis	(3.0 cr)

*Only 1 course need be completed for the major. If a student takes more than one, the course not used toward major will be counted toward the minor or elective. It is expected that nearly all students will take both a Bacteriology and a Virology option.

Second Year Fall

BIOL-L 500	Independent study	(3.0 cr)

Second Year Spring

BIOL-Z 620	Grant Writing	(1.5 cr)
**BIOL-L 524	Ethics and Career Development	(1.5 cr)

** Responsible Conduct of Research workshops offered through the Offices of the Vice Provost for Graduate Education and Health Sciences, Research Compliance, and the Vice Provost for Research can substitute for L524. Contact the Biology Graduate Office for more information.

Flexible timing

Electives	See options below.	(6-9 cr)
	TOTAL	**22.5 cr**

Students should also enroll in **independent research (BIOL-M 800)** to **total 12** cr each semester. Students can register for 0-6 cr during summer, but should consult with their PI and the Biology Graduate Office.

Elective coursework options (check iGPS and program bulletins for more options)**:** Many students find it helpful to brush up on basic bacteriology (M550 – Microbiology; Fall and Spring) or virology (M430; Spring) soon after arrival. The following is a list of just some of the possible electives a student could take.

M550 – Introductory Microbiology (taught with M250)
M430 – Virology
M480 – Microbial and Molecular Genetics
M511 – Molecular Biology of Prokaryotes
M525 – Microbial Physiology and Biochemistry (taught with M350)
B511 – Biochemistry
L472/Z620 – Microbiomes: Host and Environmental Health
Z620 – Introduction to Genomics and Bioinformatics
Z620 - Med Microbio and Med Immunology (taught with M440)
Z620 - Digital Imaging: Light Microscopy
Z620 - Quantitative Biodiversity
Z620 - Virus Fundamentals
L586 - Advanced Cell Biology

Minor requirement. The University Graduate School (UGS) requires that each student declare a "minor" in a field other than their major. Department of Biology options include Bacteriology (for students in virology focused labs), Virology (for students in bacteriology focuses labs), Genetics, and EEB. Options from other programs include applied health, biochemistry, biotechnology, chemistry, organic chemistry, education, statistics, and bioinformatics. The requirements for a minor are set by the minor field; some minors require more credits than others (the minimum is 6). Thus, students should consult with their PI and consider how a minor with >6 credits could limit the choice of electives. Please read the Graduate Bulletin for more details. Microbiology graduate students cannot get a minor in Microbiology. No course can be counted for both major and minor credit.

Grade Requirements

A student must maintain a **minimum grade point average of 3.2** to remain in "good standing" and retain a merit-based fellowship or award, including assistant instructor (AI) fellowships. For a course to count toward degree requirements, it must be passed with a B- (2.7) or better. A course cannot be counted toward degree requirements if it was completed more than five years prior to awarding of the Masters degree or seven years prior to the passing of the PhD qualifying exam. Students with a GPA of less than 3.0 or with $\geq$ 3 grades of 'incomplete' will be recommended for probation to the College Graduate Office.

Registration

Please refer to the Registrar's website for detailed instructions on how to register. OneStart is IU's web-based system for managing your registration, payments, and other tasks. You can register for classes on OneStart starting from your registration appointment through the first week of classes.

If you do not enroll before the Open Registration deadline, you may register during the first week of classes (Late Registration) using OneStart. You will incur a late fee unless it can be clearly demonstrated that the University made an error. After the first week of classes and after Late Registration closes, all classes requested must have prior department authorization.

Once registered, you can adjust your schedule using add/drop. Consult the "Drop or Add a Class" section of the Registrar's website on add/drop policies and fees.

If there are holds on your registration, OneStart will provide information about the reason, the department who issued the hold, and the steps to release the hold.

Student Academic Appointees are expected to be enrolled each semester on appointment. All appointees at or above 37.5% FTE must enroll in six credit hours each semester, and all appointees at less than 37.5% FTE must enroll in at least one credit hour each semester (summers excluded).

All doctoral candidates who have accumulated 90 graduate credit hours and Master of Fine Arts Students who have completed 60 graduate credit hours and who have completed all course requirements for the degree except the dissertation or final project, if applicable, may enroll in **G901, Dissertation Research**, which carries a value of 6 credit hours. A student may enroll in G901 no more than 6 times. G901 vs L800 can have significant financial impacts on a lab so consult with your PI and the Grad Office as you near the entry and exit of G901 status; you can also check the status of your candidacy form (or your student's form) in your **Action List**, under 'Outbox'. After G901 status has expired, the student must enroll in at least 1 credit hour of M800 each semester until the degree is completed (even if the student lives outside of Bloomington).

Students receiving fellowships must enroll in $\geq$ 6 credit hours each semester. Students scheduled to receive fellowships during the summer must register $\geq$ 1 credit hour to receive the fellowship.

Time to Degree/Major Milestones and Expectations

Your path may be different based on your circumstances. Contact the GPD and the Assistant Director of Graduate Studies (Sam Allen) if you have questions. Also see the University Grad School steps to a degree.

Semester	Courses (cr)	Other Actions/Notes (Checklist)
1 Year 1 F	BIOL-M500 (3.0) BIOL-L523 (1.5) Elect./minor (0-4.5) BIOL-M800 (to 12)	☐ Engage in Microbiology events ☐ Meet with 1st year faculty and student mentors ☐ Rotations ☐ Select a lab at end of semester
2 Year 1 S	BIOL-M511 (3.0) and/or BIOL-M541 (3.0) BIOL-M800 (to 12)	☐ Assemble advisory committee before Aug ☐ Complete advisory committee eDoc If needed: Change committee eDoc
3 Year 2 F	BIOL-L500 (3.0) Elect./minor (0-4.5) BIOL-M800 (to 12)	☐ Complete Individual Development Plan ☐ Submit committee meeting primer ☐ Committee meeting by 4th week of Nov ☐ Complete post-committee meeting report ☐ Notify Grad Office and GPD about meeting
4 Year 2 S	BIOL-Z620 Grant-writing (1.5) BIOL-L524 (1.5) BIOL-M800 (to 12)	☐ Preliminary Exam in summer or otherwise by 3rd week of semester 5. Exam must be passed at least 8 months before graduation.
5 Year 3 F	Elect./minor BIOL-M800 (to 12)	☐ Annual committee meeting, IDP (Fall or Spring) ☐ Present at Microphiles? Retreat?
6 Year 3 S	Elect./minor BIOL-M800 (to 12)	☐ All major and minor coursework complete? ☐ If all requirements met, then submit your: ☐ Nomination to candidacy application Once candidacy is approved by the UGS, submit your: ☐ NORC eDoc completed ≥ 6 months prior to graduation. Include 1-2 page dissertation prospectus.
7 Year 4 F	BIOL-M800 (to 12)	☐ Present at Microphiles? Retreat?
8 Year 4 S	BIOL-M800 (to 6)	☐ 90 credit hours reached ☐ Annual committee meeting, IDP (Fall or Spring)
Year 5+	G901 (6.0) (6 semesters max of G901)	With 90 credit hours, you can now enroll in G901. Dissertation Defense and Graduation: ☐ committee meeting ~ 6 months prior to defending ☐ write your dissertation in the specified format ☐ submit a defense announcement ≥ 45 days prior ☐ successfully defend your dissertation and revise ☐ obtain defense signatures after your defense ☐ Submit your dissertation by the deadline

1st year faculty mentor. A faculty mentor is assigned to each incoming student, prior to their settling into a dissertation lab. Students can meet periodically with their mentor throughout the 1st year and should consult with them if questions or problems with courses or rotations arise. The faculty mentor is there to help guide the student through the 1st year and is separate from the student's PI mentor who will be chosen at the end of the first Fall semester.

1st year peer mentor. A senior graduate student is assigned as a peer mentor to each incoming student. Feel free to contact your peer mentor to discuss what it is like to be a graduate student and about adjusting to Bloomington and the University.

Other resources. Entering graduate school often brings many other challenges. A list of resources within the Biology department and across the campus to help with both a personal and professional transition is included in Appendix B.

Rotations and selecting a lab. A student must join a research lab (see Appendix C) by the end of the first year to remain in the PhD program. Rotations are 5-week experiences in labs chosen, in part, by the student. During orientation, each PI actively looking to recruit students will present a short research talk to introduce you to the types of projects that they have active. To identify an appropriate research topic and environment, students are strongly encouraged to seek and interact with faculty members whose research piques their interest. In addition to meeting with faculty one-on-one, students should also feel free to talk to other students and postdocs, and read the papers published by our faculty.

2024 rotation schedule.
Aug 19: Faculty Presentations (Turkey Talks)
Aug 23: Students' First requests due by 7 pm
Aug 26/Sep 27: Start/End First Rotation
Sep 25: Students' Second requests due by 5 pm
Sep 30/Nov 1: Start/End Second Rotation
Oct 30: Students' Third requests due by 5 pm
Nov 4/Dec 13: Start/End Third Rotation
Dec 18: Student commitment requests due by 5 pm
Dec 20: Faculty Commitment decisions due by noon

Prior to each rotation period students will choose EXACTLY three labs in which they are interested in rotating and email a ranked list to the Microbiology Graduate Program Director (GPD). Once all bids are in, the GPD will contact each of the labs, starting with everyone's top choice and each faculty member will have the choice to accept the bid or pass to the next lab in rank order. This process will repeat until all students have found rotations. If any student is not assigned a rotation after this process is complete, that student will meet with the GPD to arrange a Spring

rotation(s). Students are urged to meet with faculty to discuss possible rotations prior to submitting a rotation request list. Doing so:

1. Gives the student a better idea of what goes on in the lab.
2. Let's the PI know the student is interested in advance to facilitate planning and coordination with other rotations. Note that some PIs might not be available for all rotation slots due to travel, etc.
3. Gives the lab time to prepare for the student's arrival so that they will have a smoother rotation experience.
4. Allows the student to find out how many students the lab intends to accept.
5. Accounts for the likelihood that rotation spots are only available for students that have expressed an interest. PIs are much more likely to accept a rotation for a student with whom they have spoken over a student with whom they have not spoken.
6. Accounts for the expectation that PIs generally wait for students to approach them, not the other way around.

Both the faculty and potential rotation student must be aware, however, that **no informal agreements are binding and that rotations are formally assigned only by the procedure described above.**

Rotation Expectations. When a student enters a rotation they should meet with the PI to discuss the PI's expectations for their performance in the lab. Students are encouraged to specifically ask for a lab expectations or lab culture document to help them understand the requirements and expectations of that lab. When a student exits a rotation they should expect to meet with the PI to discuss the PI's evaluation of the student's performance using the rubric in Appendix D.

Entry into a Research Laboratory: By the end of the semester, 1st-year students must choose three laboratories that they are interested in joining for their graduate career. A ranked list of laboratories, along with any comments, should be sent to the GPD. The GPD will then seek decisions from the listed faculty. Once students and faculty agree on lab placements, the GPD will confirm via email and send a list of lab placements to the Biology Graduate Office.

Students are not guaranteed positions in laboratories, although in practice this is rarely an issue. Students are expected to choose a PI based on three rotations. However, in rare cases, students do not find a home after three rotations and can try a Spring rotation(s) (usually referred to as a 4th rotation) with permission of the GPD. However, this is not recommended. The director of graduate studies (DGS) will be notified of students entering a 4th rotation so that the DGS can recommend probation to the

College Graduate Office. Students must have joined a lab by the end of the spring semester of the 1st year to remain in the program.

Microbiology events. Students are expected to attend and participate in Microbiology section events. Events are typically announced in "This Week in Biology" emails.

1. **Microbiology Seminar. Wednesdays 3pm – 4pm**.

   External speakers are invited to present their research. Students should take advantage of the opportunity to meet with the speakers and discuss science and career experiences over a complementary lunch.

2. **Microphiles. Fridays, 12:40 - 1:30 pm**

   Internal graduate, postdoctoral, undergraduate and faculty speakers are invited to present their research.

3. **Microbiology PhD Defenses (variable).**

   PhD defenses are the most important event in graduate training and all students and faculty are expected to attend.

4. **Microbiology retreat (Oct. 13, 2024).**

   Interact with ~100 other microbiologists on campus and present your findings in an encouraging, low-stress environment.

Committees

Advisory versus Research Committees. Doctoral Advisory Committees are reviewed and approved by the College Graduate Office and are only assigned until the student passes qualifying examinations. In contrast, Dissertation Research Committees are assigned **soon after the student passes qualifying examinations** and are reviewed and approved by the University Graduate School using the NORC form. In the Microbiology program, the member composition of the Advisory and Research Committees is the same. Member composition can be changed at any time in consultation with the student's PI and any committee members involved.

Advisory Committee. Student must form an advisory committee **no later than one year after admission** to the Ph.D. program by filing the advisory committee eDoc. The advisory committee must include:

- At least two members from the major area
- One member who can represent the minor
- At least two of the above members must be members of the graduate faculty

A typical Microbiology advisory committee is composed of the PI (also serves as the advisory committee chair) and three other faculty members. Students should discuss possible committee compositions with their PI before contacting faculty to serve on their committee. Students are encouraged to think about who they want on their committee and why before having this discussion with their PI. **Students must have a meeting with their advisory committee by the 4th week of November of their 3rd semester.**

Preliminary Exam Committee. The exam committee is composed of the advisory committee minus the PI. One of the committee members will be designated the exam chair by the GPD. The exam chair is an internal role and does not need to be designated on College or Graduate School eDocs. For more information, see the section on the preliminary exam, below.

Research Committee. A student's advisory committee becomes their research committee once the student passes their prelim exam and completes all of their major and minor coursework. The PI is the committee chair. However, it is important that students file the proper eDocs to make this change official. Once all requirements are met, students submit a Nomination to candidacy application. Once candidacy is approved, students must then submit a Nomination of Research Committee NORC eDoc at least 6 months prior to graduation. This form includes a non-committal 1-2 page dissertation prospectus. Most students are expected to complete this form in the semester following their prelim exam; **do not wait until your 6-month meeting.** Failure to complete this paperwork can delay graduation. **After the preliminary exam, it is mandatory that students meet with their research committee at least once every 12 months.** Monitor the status of these forms in your **Action List.** If someone forgets a sign the form, it can delay G901 status and/or graduation.

It is expected that all research advisors who accept Microbiology students into their labs will participate in committee meetings. Student preparation for the meetings and thoughtful feedback by committee members help students to: 1) avoid or minimize pursuing unproductive lines of investigation; 2) produce careful and thorough studies; and, 3) think critically and creatively about interpretations and possible future directions. Critical in-depth analysis and discussion of recent data and plans for the overall research project are crucial for the development of any research program.

Committee meetings. The procedure to schedule advisory committee meeting and student expectations for this meeting (depending on the year in graduate school are described in Appendix G).

Prior to each committee meeting with the Advisory or Research Committee, students write up and distribute to the committee a concise summary of research efforts, results to date, how they dealt with advice from the previous committee meeting, and plans for the future. For a **1st committee meeting**, the student is strongly encouraged to present possible specific aims for their project so that the committee can provide feedback and advice for what would make sense in the context of grant-writing/prelims vs the entire PhD project. For a '**6-month meeting**,' this summary should outline the dissertation to help the committee assess whether the timeline is realistic. Students must also complete an individual development plan (IDP; Appendix E) and discuss this plan with their PI prior to the committee meeting. If deemed useful, the IDP can also be shared and discussed with the committee.

At the end of each meeting, the student is asked to wait outside while the committee, including the PI, completes a rubric to document progress and highlight concerns or achievements (Appendix F). **This rubric will be submitted to the student, the GPD, and the Biology Graduate Office.** In rare circumstances of high concern, this rubric can be used to initiate a probationary period in coordination with the GPD, the DGS, and the College.

After the rubric is completed, the student is invited back into the room to receive feedback from the entire committee, including the PI. The PI is then asked to leave and the student is given the opportunity to talk with the committee about anything they would prefer to talk about without the PI present.

After the meeting, the student writes a meeting summary. After discussing the summary with the PI, the summary should be sent to the committee for an opportunity to comment.

Preliminary Exam (Qualifying Exam; see Appendix H and I)

Passing a preliminary exam (prelim exam) is required to qualify for Ph.D. candidacy. Its purpose is to establish that students have sufficient understanding of core knowledge and concepts within their field of study, have successfully transitioned from purely academic study to independent learning and critical thinking, are adequately prepared for research (ability to structure experiments to address questions, analyze and interpret data, propose logical next research steps, etc.), can effectively communicate in writing and orally with other scientist, and are making adequate progress toward a dissertation (a dissertation is a thesis for Ph.D. students).

To assess these competencies, students write and submit a proposal on their thesis research in the summer of their 2nd year (see deadlines in Appendix H). An exam

committee, composed of the student's exam committee (the advisory committee minus the research advisor (principal investigator; PI), and replacing one other member with an outside examiner). The exam committee then provides feedback on the proposal with potential requests for revisions. The exam committee also tasks the student with 6 'knowledge questions' on background knowledge within and adjacent to a student's research area. Upon receiving the knowledge questions, the student has at least 4 weeks to submit written responses and proposal revisions. The student is then orally examined on their knowledge and proposed research justification.

Deadline to take the exam. Students must complete prelim exam before October 30 their 5th semester (Year 3), including retakes, unless an exception is granted by the GPD, PI, and advisory committee. Extension requests must be justified and made well-ahead of the exam (i.e., before enrolling in grant-writing). Most exams will be during the summer.

Required documents. In most cases, the exam will involve submission of FIVE written documents: (i) a research proposal, (ii) a revised proposal, (iii) a 'marked-up' revised proposal, (iv) a $\leq$ 2-page written explanation of the major changes to the proposal, and (iv) a document containing responses to the 6 questions.

Exam scheduling. Students can schedule the oral exam at anytime. At the latest, students should schedule an oral exam upon receiving proposal feedback.

Assessment. Research proposals and responses to the 6 knowledge questions are assessed and receive pass/fail decisions by the exam committee. Performance metrics are documented using rubrics (Appendix I). Oral exam decisions will not be delivered on the same day but must be delivered with 3 working days of the exam.

Students who pass the prelim exam must enroll each semester (excluding summer sessions) for any remaining required course work or dissertation credits. Students that do not pass the exam after two attempts cannot remain in the Ph.D. program. Students that decide to not take the exam within the normal time frame, without permission, will be recommended for probation to the College Graduate Office. Students that exit the Ph.D. program may be admitted to a program leading to a Masters Degree on a case-by-case basis (Appendix O).

Candidacy and time limit

After qualifying to become a PhD candidate, **the student should not delay** in submitting a Nomination to candidacy application. Once candidacy is approved, students must then submit a Nomination of Research Committee NORC eDoc. Failure to submit these documents at this time could delay graduation.

All work offered in partial fulfillment of degree requirements must either have been completed **within 7 consecutive calendar years of the passing of the preliminary exam** or be revalidated according to procedures outlined in the Graduate Bulletin. The student must have received acceptance of their dissertation and must submit a copy to the University Graduate School within 7 years after passing the preliminary exam. Failure to meet this requirement will result in the termination of candidacy and of the student's enrollment in the program. Any student whose candidacy lapses will be required to apply to the University Graduate School for reinstatement before further work toward the degree may be done formally. The date of the successful completion of the preliminary exam (not the date of the final approval of candidacy) is used in determining the 7-year periods for currency of courses and completion of the dissertation.

At this point, the main student activities are research (enroll in M800 or G901), seminars, and taking additional advanced courses to fulfill elective requirements. For a student to remain in "good standing" requires sufficient progress toward completing a dissertation. Assessment of student progress should be formally made at committee meetings and clearly communicated to the student. More frequent and informal assessment should be delivered to the student by the PI between committee meetings. It is expected that a PhD student will have ups and downs and that the PI and committee members will help students navigate difficulties. However, if despite clear communication about inadequate progress and effort, and/or a failure of students to engage with strategies to address difficulties (e.g., connection with an expert in a relevant technique, help with time management, etc) the PI and/or other research committee must call a meeting with the student to discuss the reason(s) for concern/dissatisfaction and the student can potentially be recommended probation in coordination with the GPD, DGS, and the College Graduate Office. The probationary period provides an opportunity for the student to demonstrate effectiveness and progress in research. This research may be conducted in the same lab with the same PI or in a new lab with a different PI, if necessary and available (students are also required to be part of a lab to remain in good standing). At the end of the probationary period, if the Research Committee judges the student's progress towards the probation terms to be satisfactory, then a recommendation to lift probation will be initiated. If the Research Committee judges the student's progress towards the established probation terms remains unsatisfactory, then the student may be recommended for dismissal and

any departmental commitment of further financial support for the student will be suspended at the end of the semester during which the student is dismissed from the program. Students that withdraw from the Ph.D. program (i.e., without a recommendation for dismissal) may be admitted to a program leading to a Masters Degree on a case-by-case basis (Appendix O).

Career considerations and conferences

After candidacy, if not before, students should give greater consideration to post-graduation career options. Students should discuss career plans with their PI, their research committee, and others as appropriate. Students are also encouraged take advantage of the Walter Center for Career Achievement, including the Graduate Career Coach. Students interested in industry might also carry out an internship. Generally, a student must have agreement from their PI, have completed all requirements but the dissertation before leaving for an internship. Our internship policy is in Appendix J. Various federal agencies and national labs also offer internships, with possibilities to access powerful equipment towards a student's own dissertation research.

One of the most important ways to form professional networks towards the next stages of a student's career is to attend conferences. Students can showcase their work and interact with potential future post-doc mentors and employers. Students should generally discuss possible conferences to attend with their PI once they have enough data for a poster or oral presentation. Funding to attend conferences is available through the department and university.

Dissertation Proposal Writing and Defense

Once a student has met all of the requirements mentioned in these pages, research toward the Ph.D. dissertation becomes the focus. There are two timing rules: (i) the research committee must meet at least once a year to evaluate research progress and, (ii) the dissertation must be accepted formally within **7 years** following admission to candidacy. The dissertation must represent a body of independent, publishable work that makes a significant contribution to science. Ph.D. degrees are not awarded for purely academic achievement, nor in recognition of "time served". Programmatic expectations for earning a PhD in Microbiology are described in Appendix A.

Once the student and his/her advisor agree that the thesis is nearly done, a student should plan the dissertation defense (Appendix K). At least 6 months in advance of defense, a meeting with the research committee members must be held ("6-month committee meeting") to approve the dissertation outline and timeline. (**Don't wait** until this meeting to submit the **Nomination of Research Committee NORC** eDoc, including a dissertation prospectus, which must be submitted >6 months before the

dissertation. Failure to submit this form on time can delay graduation.) The student should then select a defense date for when all of the committee members can be present. Students must be enrolled during the period that they submit their dissertation. Students who will graduate in June, July, or August must enroll in at least 1 credit hour in either of the two summer sessions. Dissertation formatting is dictated by the University Graduate School (Appendix L).

Prior to the defense, each committee member must receive a copy of the dissertation that both the student and the PI consider to be complete and polished, including all figures and references. The university requires that dissertations be written in a specified format. This copy must be sent to the committee ≥ 6 weeks prior to the defense. Committee members are expected to read the dissertation promptly and carefully. Any major objections will be expressed at this stage and the defense may be deferred. It is more common that committee members will suggest revision of only portions of the dissertation, and then they may reserve their comments for the dissertation defense.

The dissertation defense has two parts: (i) It begins with a public seminar. A defense announcement must be submitted to the University Graduate School ≥ 45 days prior. The Department should also be notified so that they can post the seminar in "This Week in Biology". (ii) Following the presentation, the candidate meets with the research committee and is examined on the contents of the dissertation. Dissertations may be accepted in their current form (rare), rejected (also rare), or accepted pending revision (common). Once a dissertation has been revised to meet the committee's standards and the University's format requirements, the committee and research advisor certify its acceptance (defense signatures) to the Graduate School and recommend that the Ph.D. degree be awarded. More information on submitting the dissertation can be found via the Graduate School. Following the dissertation approval, the student should inform the Biology Graduate Office to coordinate the removal of "R" grades for research hours.

Teaching

Ph.D. candidates are participants in a venerable tradition that involves both learning and passing on knowledge. They have a responsibility to help teach others and to refine their ability to do so effectively. In recognition of this responsibility, all Ph.D. programs in the department require that each student teach at least 1 semester during their graduate career. In addition, it is expected that graduate students participate in the research training of other students and personnel in their labs.

It is also a requirement of the College of Arts and Sciences that all Ph.D. students take formal instruction in college teaching methods (occurs during orientation). 1st-year

students participate in the Teacher Training Session during the fall semester orientation if they will be teaching in their first year. They may opt to postpone doing this until their 2nd or 3rd year if they have fellowship support during the first 3 years.

Students that are considering teaching-intensive careers might consider workshops and other support offered by the Center for Innovative Teaching and Learning.

Student Rights and Responsibilities

As members of the Indiana University academic community, graduate students have both rights and responsibilities. Minimally, students have the right to be free of racial and sexual harassment, whether by other students or by faculty. They should also expect to be treated fairly, impartially, and with dignity as colleagues in the academic enterprise. Some of these rights are protected by specific University regulations described in the "Academic Handbook" and the "Code of Student Rights, Responsibilities, and Conduct."

Advising and other support. Normally, a student's PI will be the primary contact for advising matters. The College has outlined best mentoring practices and guidelines (Appendix M). Students can also seek advising or bring problems to the attention of other personnel including 1st-year faculty and student mentors, the GPD, Graduate Advisor, DGS, etc (Appendix B). These personnel, or the students themselves, can also work with Division of Student Affairs as needed for both internal and external matters, such as landlord disputes. IU also offers Counseling and Psychological Services (CAPS).

Students can also take advantage of the vibrant communities within the Department and the University. These include the Microbiology Graduate Student Association. See Appendix B for list of advisors, organizations, clubs, and resources available in the department and at the university.

Student Academic Appointee (SAA) requirements. Students also have responsibilities both as scholars and as teachers. Students must meet the expectations outlined in the SAA contract to remain in good standing. See the current contract (signed prior to each semester). More information, including grievance procedures are in this portal.

SAA contracts apply to both research and teaching. However, SAA contracts are separate from a student's expectations as a student, which also including adequate research progress and maintaining a GPA above 3.2. Thus, the required SAA hours are not meant to indicate the hours necessary to succeed as a productive graduate student.

As teachers, graduate students are subject to the same rules that apply to faculty, rules that are designed to protect the students they teach against bias and harassment. Associate Instructors (A.I.s) should make themselves aware of these rules. Beyond the rules, A.I.s should be aware that they will be important role models to undergraduates and that their behavior toward their students should be beyond reproach.

Academic misconduct.

For members of the scholarly community, the cardinal rule guiding both academic and research work is one of honesty and open attribution. Academic misconduct, including plagiarism, cheating, fabrication, interference, and facilitating dishonesty by others will be punished severely when detected. Credit for ideas, experiments, models, etc. must be given to their originators. Graduate students are expected to be informed on such matters, and faculty are alert to intellectual theft whether in papers, examinations, or purportedly original work.

Definitions of academic misconduct can be found in IU's Code of Student Rights, Responsibilities, & Conduct, including plagiarism, referenced in 2023 as:

"Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered "common knowledge" may differ from course to course.

a. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.
b. A student must give credit to the originality of others and acknowledge indebtedness whenever:
    1. directly quoting another person's actual words, whether oral or written;
    2. using another person's ideas, opinions, or theories;
    3. paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;
    4. borrowing facts, statistics, or illustrative material; or
    5. offering materials assembled or collected by others in the form of projects or collections without acknowledgment"

In class assignments, preliminary exam documents, and research manuscripts, your writing should:

- reflect your thinking and interpretation of what you read and hear

- express ideas in your own words
- give credit to the sources of the ideas

A good strategy is to make yourself to do the writing without the primary references in front of you. That will force you to use your own words.

When cases of plagiarism are discovered, the disciplinary actions are severe and will follow the IU guidelines for addressing academic misconduct:

For a 1st incident of plagiarism, we will assign a 0 on the assignment that contained a plagiarized portion(s) and notify the Dean of the Graduate School and the Dean of Students. After a 2nd incident of plagiarism, we will recommend to the Deans that the student be dismissed from our graduate program. Note that the Deans can also add sanctions to a 1st incident of misconduct, including probation, suspension, or dismissal. **In the preliminary exam, a first incident of plagiarism may lead to a recommendation of dismissal to the Deans, without a 2nd attempt at the exam.**

Note that IU currently considers the submission of content generated by artificial intelligence (e.g., ChatGPT, Google Translate, etc.) to be an example of academic misconduct, though there are ways to use artificial intelligence that would not be considered academic misconduct. Users of artificial intelligence should (i) consult the PI, instructor, examiners, etc. about its use (ii) disclose, its use including how it was used, and (iii) cite resulting content properly, (iv) ensure that any resulting information is accurate, permissible for re-use, and original such that it couldn't be classified as plagiarism. Program guidelines on AI usage are in Appendix S. Strengths and limitations of AI tools are at: pubs.acs.org/doi/full/10.1021/acsnano.3c01544.

Funding and Financial Assistance

Various funding sources aside from SAA research assistantships and associate instructorships exist within and outside of the Department. Students are encouraged to apply for fellowships and awards, including full semester support opportunities via the University (e.g., Kindig fellowships, for 3rd-year students) or from external sources (e.g., National Science Foundation Graduate Research Fellowship Program; NIH F31 grants; Indiana Space Grant Consortium; etc.). Many opportunities are summarized via the Grad Student Portal. U.S. citizens may be eligible for support from training grants if their PI is trainer on the grant. Students should inquire about current training grant opportunities with their PI.

The University sets standards of English competence for associate instructorships. To make sure that all funding options are available to students whose native language is not English, it is critically important that foreign students meet those standards as early as possible during their graduate careers.

Human Subjects

Research involving human subjects should comply with the IU Office of Research.

Appendix A. Programmatic requirements for a Microbiology PhD

A doctoral degree in Microbiology is earned by scholarly productivity and is not simply an award to students for completing a number of years in graduate school. As part of their training, students should gain both breadth and depth in field of Microbiology (as evidenced by passing both phases of the preliminary exam), conduct research, answer important scientific questions, and should learn how to communicate their science (with presentations at local talks, conferences, and in written form with manuscripts). To ensure that a uniform standard is met, we have set minimal criteria that each student must attain. The College Graduate Office and the University Graduate School has additional criteria that must be met for a student to earn a Ph.D. (see elsewhere in this handbook).

Committee members are tasked with the responsibility of ensuring that the following criteria are met before students schedule a defense of their doctoral dissertation. Students must:

1. Complete required coursework (refer to Microbiology handbook for the year you started in the PhD program) and maintain a GPA of 3.2
2. Complete requirements for selected minor
3. Pass the Microbiology preliminary exam
4. Serve as an Associate Instructor (AI) for a minimum of one semester and receive a satisfactory performance evaluation
5. Complete an Individual Development Plan (IDP) prior to their first committee meeting in the 2nd year of the program. The student should continue to update their IDP prior to meeting with their committee each year after they have passed the preliminary exam.
6. Hold a committee meeting each year (First meeting is Fall of year 2 and at least once each academic year in subsequent years)
7. Present their research progress to the microbiology faculty and students (e.g. a Microphiles presentation) at least once by the end of year 4 in the program. This presentation should be greater than 30 min in length.
8. Present their research as a poster or talk at a regional, national, or international conference. Presentation at the Microbiology retreat is not sufficient to fulfill this requirement.
9. Hold a 6-month meeting and obtain approval from the committee to schedule a dissertation defense.
10. Publish or submit at least one first author primary research paper before doctoral dissertation is submitted to the committee.
11. Beyond these general expectations, the specific components of each dissertation will be determined by the candidate, their mentor and the dissertation committee.

*Note that reaching these standards does not guarantee that a student will be allowed to defend. We expect that most students will exceed these requirements.

Explanations for requirements 3-9:

Preliminary exam:

The Preliminary Exam serves to distinguish students who have successfully made the transition from purely academic study to independent learning, are adequately prepared for research, and are making adequate progress toward a thesis. The two phases of prelims in biology test both the breadth and depth of the student's knowledge in Microbiology.

Teaching requirement:
Learning to teach others is an important part of graduate training. Thus, each student must teach (by serving as Associate instructor) at least one semester during his/her graduate career. The student should take this task seriously, work with the instructor effectively, and earn at least a satisfactory evaluation for their teaching. In addition, it is expected that graduate students participate in the research training of other students and personnel in their laboratories.

Individual Development Plan (IDP):

An IDP provides a template to identify annual academic and scientific goals and progress, professional development needs, and career objectives for graduate students. In addition, the IDP serves as a vehicle for communication between the graduate student and his or her mentor (PI).

Yearly Committee meeting:
Critical in-depth analyses, discussion of data, and plans for the overall research project are crucial for the development of any research program. Both preparation for the meetings and thoughtful feedback by committee members help students to: 1) avoid or minimize the pursuit of unproductive lines of investigation; 2) produce careful and thorough studies; and, 3) think critically and creatively about interpretations and possible future directions.

Presentation to the Microbiology Program:
A venue such as the Microphiles series allows student to gain experience practicing their presentation skills, including answering questions. Moreover, since the audience is fairly diverse, students can learn how to present to a broad audience. Finally, this forum offers opportunities for the student to receive feedback and suggestions from Microbiologists (faculty, staff, and students) that do not serve on the students' advisory committee.

Presentation at a regional, national, or international scientific meeting:
Presentation at a major scientific meeting is an important part of a student's training. It helps help familiarize students with the research in their field and meet other researchers. It is also an opportunity for the student to learn how to talk about and defend their research to a professional scientific audience. The networking opportunities at such meetings will facilitate the transition to the next phase of a student's scientific career.

Publication requirement:
Publication of a first-author paper indicates that a student is capable of solving a biological problem and is able to take a study to completion. It is also important to consider that the stated single publication requirement is a minimal programmatic bar for the Ph.D., and a strong doctoral career will consist of greater levels of productivity. It is expected that most dissertation documents will contain a minimum of three major data chapters, each of which will constitute a publishable unit of research.

Appendix B: Resources for students

To Whom Do You Turn When You Encounter Problems As A MICRO Graduate Student?

MICRO Graduate Program, Department of Biology, Indiana University
Adapted from Spencer Hall, EEB Graduate Program Director
Updated: March 20, 2023

It is common, at some point or another, for students run into difficulties - problems with advisors, funding, degree requirements, mental health problems, etc. There is someone to turn to for help solving problems that you encounter. Part of the challenge involves deciding where to start. Here are some suggestions.

(1) Your advisor (PI) and committee
Your advisor and/or your committee should be your first stop for problems that you encounter. Advisors are paid to help you solve your research and intellectual problems, and most advisors strive to provide the best career mentoring advice, etc. Your other committee members also have a duty to help you become the best scientist possible. They can offer you excellent advice an all sorts of matters. Of course, sometimes your advisor or a committee member might be the problem. Use your discretion in deciding who to approach. In some cases, it is actually most productive to raise the problem with the person you have a problem with.

(2) Formation of other mentor-mentee relationships
It can be unrealistic to expect your advisor to serve as a perfect mentor and role model on all aspects of your graduate life. It is encouraged that you seek out relationships with other role models - faculty and graduate students - that can help you. Keep in mind that your advisor likely expects to be your primary mentor. Shutting your advisor out from all mentoring would likely cause tensions.

(3) Asstistant Director of Grad Studies – *Sam Allen,* MY 150, 5-2785, biogrdav@iu.edu
The Asst. Director of Grad Studies (formerly the Graduate Advisor) can help you navigate the myriad complexities of the partially overlapping bureaucracies at IUB (Micro program, Biology, the College, and the University Graduate School [UGS]). They are extremely knowledgeable about the many deadlines, forms, requirements, etc., that you must complete. They can also offer career guidance and general help with graduate life.

(4) MICRO Grad Program Director (GPD) – *Jake McKinlay*, BB447, 5-0359, jmckinla@iu.edu
The GPD leads the Microbiology Graduate Program. This person (a Micro Faculty Member, elected to serve for multi-year terms) is the first person to whom you should describe difficulties that you are encountering as a graduate student (but see the Title IX exception below), that cannot be addressed by your advisor and or committee. The GPD can help with:

* conflict resolution between you and your advisor;
* difficulties with timing of degree requirements;
* leave requests, petitions to the College or UGS;
* switching labs (last resort; other prior steps to resolve conflicts are expected)

* other issues that come up, involving mental health, workplace harassment, etc.

The GPD typically consults with the Micro Section Associate Chair (SAC) and the Director of Graduate Studies (DGS) when needed but also maintains confidentiality when needed (and not constrained legally - see Title IX below).

Please note: In the event that a student of the GPD or a student of the spouse of the GPD needs help but the GPD poses a conflict (i.e., the problem is about the GPD or the spouse), the student should consult the DGS and/or the SAC and/or committee members.

(5) Bio Director of Grad Studies (DGS) – *Heather Reynolds,* 5-0792, BB 155A, biodgs@iu.edu
The GPD communicates regularly with the DGS about problems that arise with graduate students. That said, if students do not find satisfactory resolution of problems with the GPD, the DGS stands ready to help. Typically, the DGS interfaces with UGS and College Administrators, while GPDs manage day-to-day functions of the graduate programs in Biology.

(6) MICRO Section Associate Chair (SAC) – *Irene Newton*, 5-3883, MY 216A, irnewton@iu.edu
The GPD serves alongside the DGS, the SAC, and Department Chair. Problems that cannot be resolved by the GPD (or problems involving the GPD) can be brought to the SAC. The GPD and SAC communicate regularly about problems that arise, but typically involving faculty or funding.

(7) Biology Department Chair – *Armin Moczek*, 6-1468, armin@iu.edu
The Chair oversees operations of the entire department. We recommend that the Chair is not consulted early on, as the Chair has a very large portfolio of matters to tend to. Instead, students should work from GPD to DGS/SAC as needed first. That said, the Chair will welcome conversation about your concerns. Additionally, the GPD communicates with the Chair about concerns arising with students in the program.

(8) Ombudsperson – *Rich Holdeman, 5-3793, rholdema@iu.edu*
The ombudsperson can serve as a neutral mediator in matters concerning Biology coursework. Examples of matters to bring to the ombudsperson can be found here.

(9) Mental Health - Counseling and Psychological Services - CAPS | Care referral (link)
Students praise effectiveness of the counselors, therapists, and psychiatrists at CAPS. The GPD can refer students to CAPS and encourages that students manage their mental health challenges with the effective and supportive help offered by CAPS. Anyone – students, PIs, committee members, GPDs, etc. – can submit a care referral. These tips activate various services in support of students experiencing stressors from mental health, physical health, financial insecurity, etc.

IU also has a partnership with the remote mental health service TimelyCare.

(10) Title IX - Stop Sexual Violence (link)
IUB is committed to providing a safe work and learning environment, free from sexual violence. Students with Title IX concerns should voice them with their advisor first. If that is

not possible or desired, students should confer with a Title IX officer (liaison) in Biology. These liaisons are:

* Jennifer Tarter, Administrative Assistant to the Chair, jenjones@iu.edu
* Shana Wigington, Human Resources Representative, shwiging@iu.edu

If you are experiencing a title IX concern as a victim:
We encourage consultation with both advisors and Biology's liaisons. Additionally, the University has Title IX coordinators if those consultations are not possible (see here for IUB contacts). Reports of Title IX concerns to advisors, Biology liaisons, or any other persons considered 'responsible employees' (described in the policy), **must** be reported to the Title IX Office on campus. The advisor and/or Biology liaison should also consult with the Department Chair if the problem could pose a threat to others or reflect a systemic problem beyond the focal incident.

If you are learning of a Title IX concern:
All grad students should consider themselves as "responsible employees" following Biology's policy (which is grounded in University policy UA-01, UA-03). ALL graduate students have responsibility to report Title IX concerns to the Title IX Office on campus. No one can keep Title IX concerns "confidential" - you must report them. *It is important that all graduate students understand this part of the policy from Biology and the University.*

What this means for the GPD's relationship to graduate students:
Title IX creates legal situations in which the GPD is usually **not** the first point of contact. The Chair will inform the GPD if necessary about concerns. Concerned students can still consult with the GPD but if the GPD is the only 'responsible employee' informed, the GPD must contact IUB's Title IX office. Confidentiality is not guaranteed in this case (unlike in other, non-Title IX issues). For Title IX concerns, confidentiality is only assured if they talk to a 'confidential employee' (see Biology policy for more information).

(11) Office of Institutional Equity (link) | Fill out a Bias report (link)
IUB is committed to ensuring that the work and learning environment is free of discrimination of any sort. While the GPD also wants to know right away of any discrimination or harassment concerns, students should know that they can consult with and get advice from the Office of Affirmative Action. They can file complaints with this Office as well.

(12) Other Relevant Deans and Offices
It is rare that students need to consult directly with Deans in UGS and the College. However, the Asst Director of Grad studies and the DGS do communicate regularly, with:

- The University Graduate School (**UGS**) staff (**link**)
- The **IU College Graduate Office**
  The College Office of Diversity + Inclusion (link)
- The Office of Student Life (formerly the Division of Student Affairs) (link):
  - The Office of Student Conduct offers help with conflict mediation; the GPD might suggest enlisting a trained 3rd-party mediator if both a student and advisor are unable to resolve an interpersonal issue but remain committed to work through the problem (link)

- The Student Advocates Office can also provide assistance (link)
- Legal support, e.g., for landlord disputes (link)

Most communication with these Administrators, on behalf of students, comes from the GPD, DGS, or Asst Director of Grad Studies. However, in extreme circumstances, you can request appointments with Deans in UGS or the College Graduate Office.

(13) Office of Student Life (formerly the Division of Student Affairs**).**
Some matters involving the Division of Student Affairs don't need to go through the GPD, DGS, or Advisor. This division can also help with matters outside of IUB, such as legal support in disputes with landlords.

(14) Student representation
The Microbiology Graduate Student Association (MGSA) organizes social and professional events for Micro grad students and can work with the GPD and others to better the grad student experience. MGSA has multiple student positions.

EEB ORG maintains broadly useful graduate resources page (g-doc).

IUB graduate students are also represented by the Graduate and Professional Student Government (GPSG) and the IU Student Government (IUSG).

(15) Career and professional resources.
The Walter Center for Career Achievement can help you plan and move towards the next stages of your career including through the use of a Graduate Career Coach. IU also has a graduate mentoring center. You can also get teaching advice and take workshops from the Center for Innovative Teaching and Learning.

(16) Funding opportunities
- Biology awards page (contains links to departmental, College, University, and external awards)
- AAAS Science Magazine – Where to search for funding
- National Science Foundation Pre-doctoral Graduate Fellowships
- National Institutes of Health Pre-doctoral Graduate Fellowships
    - Eligible to apply once you join a lab, the earlier you start the better
- Department of Energy, Office of Science, Graduate Fellowship Program
- NRC Research Associateship Programs
- Indiana Space Grant Consortium

(17) Internship opportunities
An internship can be a great way to learn more about job opportunities, especially outside of academia. Please see the accompanying Microbiology internship policy. Note that many large companies have formal internship opportunities that can require applying far in advance. If you are interested in working at a company pharmaceuticals, biotech, big Ag, etc, make sure to visit their

websites or email them to find out more about applying for an internship. Several federal agencies also support internship opportunities including:

USDA's Internship Program.
The CDC offers several programs.
NSF's INTERN program | For students or PIs with NSF active grants (GRFs included).
DOE's Graduate Student Research (SCGSR) Program | Supports part of dissertation research at a DOE laboratory/facility. Only eligible for students who have advanced to candidacy.
UGS's Future Faculty Teaching Fellowship | Supports teaching at a regional IU campus, Butler, or an HBCU.
Pathways To Federal Careers | USGS Cooperative Summer Fellowship Program | USFWS Direct Training Program |

(18) Financial/emergency planning

- IU Moneysmarts
- Renters insurance for your apartment is a must. There might be some options geared towards student budgets.
- Are you familiar with Midwest weather? If not, ask for advice how to save money and protect your property from frozen pipes, heat waves, torrential downpours, etc.
- Find yourself in a financial emergency? Talk to the GPD and/or your PI. There are a few IU options that might help, but keep in mind that IU cannot substitute for insurance.

(19) Other IU groups of support or interest

- BeInvolved (where you can find most official IU student organizations and clubs, including our own MGSA; international students looking to connect with others studying abroad can likely find groups of interest here)
- Women in Science
- Society for the Advancement of Chicano/Latino and Native American Scientists (IU SACNAS)
- La Casa Latino Cultural Center
- Neal Marshall Black Culture Center
- LGBTQ+ Cultural Center
- First Nations Educational & Cultural Center
- Asian Culture Center

Appendix C. Micro training Faculty and how to choose a lab

Microbiology Core Training Faculty

Lab	Subject	Dept
Dalia, Ankur	Natural transformation and horizontal gene transfer	Bio-Micro
Danthi, Pranav	Viral and cellular determinants of virus-induced cell death and disease.	Bio-Micro
Dharan, Adarsh	Viral nuclear import, HIV-1, drug discovery	Bio-Micro
Fuqua, Clay	Multicellular interactions of bacteria.	Bio-Micro
Hardy, Rich	Genome functions of RNA viruses and virus-host interaction.	Bio-Micro
Kearns, Dan	Bacterial motility and multicellular behavior.	Bio-Micro
Kehoe, David	Environmental regulation of gene expression in bacteria.	Bio-Micro
Landeta, Cristina	Disulfide bond formation; biotechnology; microbial interactions and pathogenesis	Bio-Micro
Limoli, Nicki	Molecular interactions during polymicrobial infections	Bio-Micro
McKinlay, Jake	Microbial metabolism in physiology, ecology, and biotechnology	Bio-Micro
Mukhopadhyay, Tuli	Structure and assembly of enveloped, RNA viruses.	Bio-Micro
Newton, Irene	Functional genomics of environmental microbes and symbiosis.	Bio-Micro
Patton, John	Replication of rotavirus, innate immune responses to viral infection	Bio-Micro
Rowe-Magnus, Dean	Integrons and Super-Integrons; biofilm formation; natural competence; ecology and pathogenesis in the Vibrionaceae	Bio-Micro
van Kessel, Julia	Regulation of 27uorum sensing and other group behaviors	Bio-Micro
Wang, Xindan	Bacterial chromosome organization and segregation	Bio-Micro
Winkler, Malcolm	The physiology, pathogenesis, molecular genetics, stress responses, and genomics *of Streptococcus pneumoniae*.	Bio-Micro

Microbiology Affiliated Training Faculty

Lab	Subject	Dept
Bashey-Visser, Farrah	Evolution of social strategies and virulence	Bio-EEB
Bochman, Matt	Genome integrity, DNA helicases, microbiology of fermented beverages	MCB
Bush, Karen	Antibiotic mechanisms of action and resistance.	Btech
Chen, Lingling	Protein-protein structural interactions in GroEL-mediated protein folding and microbial communications.	MCB
Choi, Kay	replication of RNA viruses; structure and function of viral RNA; development of RNA scaffolds for X-ray crystallography and cryo-EM	MCB
Gerdt, J.P.	Interkingdom symbioses	Chem
Innes, Roger	molecular genetics of plant/pathogen interactions	Bio-GCDB
Lennon, Jay	Microbial ecology and evolution	Bio-EEB
Marc Morias	Viral particle assembly, anti-viral therapeutics, nanomachines	MCB
Phillips, Rich	Consequences of human-accelerated environmental change on plant-soil-microbial interactions.	Bio-EEB
Zlotnick, Adam	Biophysics of virus assembly, development of antiviral strategies, and construction of virus nanostructures.	MCB

Things to consider when choosing a lab.

- Do you like the science?
- What projects does the PI have in mind for you? These could be different from your rotation.
- Do you like the PI?
- Does the PI's mentoring style work for you?
- What are the expectations of the PI and do those work for you?
  You might consult the **lab culture statement** for more details.
- What are your expectations from your PhD and will the lab fulfill these?

- How many papers you would like to publish? What kinds of papers do you want to publish?
- Do you want a hands-on mentor or someone who allows for plenty of independence?
- Does the lab facilitate your current post-PhD career goals?
- Is the lab environment suitable for you?
- Does the PI have funds to support you? Will you need to AI or can you work as an RA? You can ask the PI directly. Does AI vs RA matter to you?

You were assigned peer and faculty mentors. You could talk to them for advice or just use them as a sounding board. If you'd rather talk with another faculty mentor, that's fine too.

Talk to people in the lab. Ask them why they made their decision. Ask them if they regret their decision. Ask them if they learned something about the lab that they didn't expect.

Be wary of rumors. If you hear something, ask an informed source about it, and ideally multiple sources. The informed could be the PI, lab members, or other faculty. What doesn't work for someone else could be a good fit for you; conversely, what could be a good fit for someone else, might not work for you.

Answers to some of these next questions are a personal choice and not universally good or bad.

- What are the chances that you have trouble finding a spot in a lab?
- Certain labs are popular rotations labs that might have had more rotations students than spots available. It's possible that you are not one the people they will take. Assess your chances. Ask the PI how many students they will take and how many rotations they have had.
- Faculty want students. If no one has explicitly said that they will not take you, then you should have a chance to join. In cases where none of the three labs work out, there are options for a 4th rotation in Spring. If you think this applies to you, contact the graduate program director so they can explain the pros and cons of this to you. Also consult the handbook.

How to inform faculty? If you want to join a lab, let the PI know you are putting them down as first choice. Though no decision is final until the graduate program director places someone in a lab, it's good to have that conversation so that the PI knows you are considering their lab.

How to inform your 2nd or 3rd choice - some students struggle with this. They think it's like breaking up. It's not! This is a professional decision. No one will hold anything against you if you don't end up joining their lab. If you can, let a lab know that they are not your first choice lab so they can plan accordingly. If for some reason the interaction is not professional, let the graduate program director know.

Can I make my decision early?
You are welcome to send the graduate program director your list before the deadline but the director cannot do anything until they have everyone's choices.

Appendix D. Rotation rubric

Rotation Period: Fall 1, Fall 2, Fall 3
Please evaluate the rotation student in the following categories, modify comments as appropriate:
Grading scale: 21-30 = A; 16-20 = B; 1-15 = C

	Exceeds expectations 3 points each	**Acceptable 2 points each**	**Insufficient 1 point each**
Attendance Work ethics Punctuality	Spends over expected time in lab Excellent work ethics Punctual	Spends expected time in lab (~20 hours per week) Good work ethics Punctual	Not enough time spent in lab Work ethics needs improvement Misses meetings
Organization	Superior organization skills improve efficiency in lab	Good balance between planning, executing, and analyzing experiments	Unfocused Disorganized Forgetful
Understanding of project	Reading and thinking go beyond specifics of project	Understands big picture and specifics of project	Effort and/or background insufficient for good understanding
Independence (by the end of the rotation)	Confident Rapidly became independent but kept mentor informed	Good balance between seeking instruction and working independently	Timid Unable to execute or analyze experiments independently
Productivity	Went beyond rotation goals and/or results advanced project in the lab	Completed rotation goals	Problems in one or more of the above areas impeded progress
Discussion of project with mentor and PI	Clear, organized, thought-provoking, and engaging discussions.	Clear and well-articulated explanation of all aspects of project	Unclear explanations and/or insufficient preparation
Oral presentation	Thought-provoking, engaging	Clear, logical, concise	Confusing, disorganized
Written communication	Superior writing ability, able to tie specific goal of the project to big picture	Clear, logical, concise, and complete	Substantial problems with grammar, sentence structure, flow, and/or logic
Attitude and interaction with others	Makes special efforts to interact with lab members and discuss science. Considerate of others	Good interaction with lab members and good lab citizen.	Insufficient interaction with and/or inconsiderate of lab members; difficult interaction with mentor and/or professor.
Interest in science	Enthusiastic, excited, highly-motivated	Interested and involved in the process	Indifferent or disengaged

Disclaimer: The following two checkboxes in no way constitute a commitment either from the student or from the faculty member that the student will eventually commit to joining the lab. The boxes below only indicate the willingness of the faculty member to consider that student among potential candidates for a position in the lab at time the commitment process is formally initiated.

___ I am willing to consider this student for a spot in my lab.

___ I am unwilling to consider this student for a spot in my lab.

Additional comments (if necessary):

Appendix E. Individualized development plans

The Individual Development Plan (IDP) provides a planning process that identifies annual academic and scientific progress, professional development needs, and career objectives for graduate students. The IDP serves as a communication tool between the student and their mentor (PI). Each student should complete and submit an IDP at the time of their annual committee meeting. Other IDP formatss, such as the latest online **AAAS MyIDP**, are allowed in consultation with your PI.

Goals of the IDP:

Help the graduate student identify:
Short-term needs to achieve goals.
Long-term career options and goals and necessary tools to meet these objectives.

Benefits of the IDP:

Identifying short-term goals will give graduate students a clearer sense of expectations and help identify milestones along the way to achieving specific objectives. Students will have a process that assists in developing and achieving long-term career goals. The IDP provides a tool for communication between the graduate student and the mentor (PI).

Outline of the IDP process:

The development, implementation, and revision of the IDP requires a series of steps to be conducted by the student and the PI. These steps are an interactive effort. Thus, both the student and the PI must participate fully in the process.

How to complete the IDP:

Basic Steps	For Graduate Student	For Mentor
Step 1	Write an IDP Share IDP with mentor and revise	Review IDP and help revise
Step 2	Implement the plan Revise IDP as needed	Establish yearly progress review
Step 3	Survey opportunities with mentor	Discuss opportunities with student

Additional Information:

My IDP: http://myidp.sciencecareers.org/

Graduate Student Name: PI Name:
Student Signature: Date: PI Signature: Date:

I. Research Projects - Briefly describe the aims of your current research:

II. Annual Progress Report

A. List or briefly describe academic achievements (e.g., courses and workshops completed):

B. List or briefly describe major research accomplishments this year (do not include publications or presentations here):

C. Briefly describe one or two discussions of Responsible Conduct of Research (RCR) topics you had in the last year with your mentor, thesis committee members, other faculty, or coworkers.

D. List references for publications submitted or published this year:

E. List references for abstracts that were presented at meetings or retreats. In each case, underline your name in the author list.

F. List your funding sources and grants applied for or received this year. Describe your visa status if appropriate:

G. List honors and awards received this year:

H. List intellectual or technical collaborations established or continued this year:

I. List accomplishments this year in other aspects of career development (e.g., teaching, university service, etc.)

J. Are you satisfied with your academic progress in the past year? If not, why?

K. Are you satisfied with your research progress in the past year? If not, why?

L. Are you satisfied with other aspects of your career development in the past year? If not, why?

III. Self-Assessment of Skills

Using the table on Page 4, reflect on your level of development in seven competency areas important for success in research: 1) Scientific Knowledge; 2) Research Skills; 3) Communication; 4) Professionalism; 5) Management and Leadership Skills; 6) Responsible Conduct of Research; 7) Career Advancement.

For each competency area, put an "x" in the column that most accurately describes your current level of expertise. Mark only one column per competency.

Always consider your career stage when assessing your competencies. Avoid comparing yourself to colleagues who are significantly more junior or senior than you.

For example, as a 2nd year student, you may have a broad based knowledge of science that is appropriate to your career stage, but seemingly inadequate compared to a student who is about to defend their thesis. In this case, "appropriate for career stage", not "needs development", is best.

Ask your research mentor to review your answers with you.

Pay attention to the skills for which you answered, "No basis to evaluate" or "Needs development." Are these skills you need to hone for your anticipated career path? Similarly, review skills that you identify as "strengths." You may wish to consider career paths that capitalize on these skills.

Core Competencies	No basis to evaluate	Needs development	Appropriate to career stage	Strength
Scientific Knowledge				
Broad based knowledge of science				
Deep knowledge of specific research area				
Critical evaluation of scientific literature				
Research Skills				
Technical skills related to research area				
Experimental design				
Statistical analysis				
Interpretation of data				
Creativity/innovative thinking				
Navigating the peer review process				
Communication				
Basic writing and editing				
Writing scientific publications				
Writing grant proposals				
Writing for nonscientists				
Speaking clearly and effectively				
Formulating and asking sound questions				
Presenting research to scientists				
Presenting to nonscientists				
Teaching in a classroom setting				
Training and mentoring individuals				
Seeking advice from advisors and mentors				
Negotiating difficult conversations				
Professionalism				
Demonstrating workplace etiquette				
Complying with rules and regulations				
Upholding commitments and meeting deadlines				
Maintaining positive relationships with colleagues				
Contributing to discipline (e.g. professional society member)				
Contributing to institution (e.g. committee participation)				
Management and Leadership Skills				
Providing instruction and guidance				
Providing constructive feedback				
Dealing with conflict				
Planning and organizing projects				
Time management				
Managing research resources responsibly				
Leading and motivating others				
Creating vision and goals				
Serving as a role model				
Responsible Conduct of Research				
Careful recordkeeping practices				
Understanding of data ownership/sharing issues				
Demonstrating responsible authorship/publication practices				
Demonstrating responsible conduct in human/animal research				
Able to identify and address research misconduct				
Able to identify and manage conflict of interest				
Career Advancement				
Creating and maintaining a professional network				
Tracking prof. devel. /accomplishments (e.g. maintaining a CV)				
Interviewing				

IV. **Plans for Upcoming Year**

A. Academic plans for the upcoming year:

B. Research project goals for the upcoming year (be brief):

C. What are your plans for improving your scientific writing skills and oral presentation skills in the upcoming year?

D. Anticipated publications to submit in the upcoming year (indicate project titles):

E. Anticipated meeting and workshop attendance in the upcoming year:

F. Grant or other funding applications planned for the up-coming year. Describe your plans to alter your visa status if appropriate:

G. Anticipated collaborations to establish in the upcoming year:

H. Anticipated other professional training in the upcoming year (e.g., teaching, course work, workshops, etc.):

I. How can your mentor help you achieve your goals for the upcoming year? What specific plans would you like your mentor to implement?

V. Career Goals

A. Approximately when do you anticipate finishing your predoctoral training? What is your plan and timeline for achieving this goal?

B. What is your "Next Step" career goal (e.g., postdoctoral training, research job, science policy, science communication, teaching, additional education)?

C. What are your long-term career goals? (*ScienceCareers* MyIDP can help you evaluate your options in light of your interests and skills.) What is your plan and timeline for achieving them?

D. What further research activity or other training is needed before it is appropriate to start a job search?

E. In reference to your career goals, what resources can your PI provide or help you find?

Appendix F. Committee meeting rubric and checklist

Only a single rubric need be completed each committee meeting. Comments can take into account the observations of both the PI and other committee members. Evaluations of satisfactory (S) or unsatisfactory (U) should be as appropriate for the stage of the students graduate career.

Date:

Committee members:

Student:

	S/U	Comment:
Background knowledge		
Understanding of research direction		
Productivity/ accumulated data		
Written communication		
Oral communication/ committee engagement		

If this was a 1st meeting, were draft aims presented? ___

If this was not a 1st committee meeting, was previous advice considered (see post-report)? ___

If this was a '6-month meeting' was a dissertation outline and a realistic timeline presented? ___

Other comments:

Committee meeting checklist

This checklist is meant to concisely address frequently asked procedural questions. The checklist does not need to be submitted to anyone. More details in each step are in Appendix G.

Before the meeting:

- ☐ Pre-meeting primer written by student and sent to advisory committee
- ☐ IDP completed by student and discussed with the PI

During the meeting:

- ☐ Rubric completed by committee and sent to the GPD and grad office

After the meeting

- ☐ Post-meeting report written by student, discussed with PI, shared with committee

Suggested committee meeting templates

Pre-meeting primer

- Brief rationale for project
- Accomplishments since last meeting; include figures
- Outcomes from feedback/suggestions from last meeting
- Brief plan for coming year/path to graduation

Post-meeting report

- Main research feedback with action items
- List of any action items outside of the research project (e.g., coursework, conferences, networking contacts, internships, items that arose via IDP, etc)

Appendix G. Committee meeting requirement and procedure

Critical in-depth analyses, discussion of data, and plans for the overall research project are crucial for the development of any research program. Both preparation for the meetings and thoughtful feedback by committee members help students to: 1) avoid or minimize the pursuit of unproductive lines of investigation; 2) produce careful and thorough studies, and 3) think critically and creatively about interpretations and possible future directions.

Each student must have at least one committee meeting each academic year starting in the 2nd year of graduate school.

For each student, the first meeting must occur before the 4th week of November their 2nd year.

Students will write and defend their dissertation proposal in the summer between year 2 and 3 of graduate school. Defense of the proposal can count as a committee meeting. This meeting will occur over the summer between 2nd and 3rd year and must be completed before the 4th week of the Fall semester of the 3rd year. Please refer to instructions for preliminary exam for details.

How to schedule a committee meeting

1. Email to identify a range of weeks that your committee members are available BEFORE sending a specific poll (e.g., When2Meet, Doodle)
2. Pick one week that is open for all members (including the PI) and send a poll. When2Meet is usually better to identify overlapping availability. Alternatively, use a Doodle poll with two-hour time slots but do not provide a cumbersome number of options. If a common time is not available, try another week later in the semester.
3. Once a date/time is set, reserve a room (and projector if needed) and email the entire committee the final date/time/place.

How to prepare for a committee meeting

1. Complete your IDP document and meet with your advisor to discuss this document. Edit as needed following this discussion. The student does not need to complete an IDP before they meet with the committee to defend their dissertation proposal in the prelim exam.
2. Write a pre-committee meeting report.
    i. Limit: 2 pages of text. You should include key figures and references and these do not count toward the page limit.
    ii. Label your PDF file: NAME_pre-committee meeting report_YEAR
    iii. The document should include introduction, data, and future directions.
    iv. It is expected that as a student progresses through graduate school, preliminary evidence presented early in his or her career will be replaced by data.
    v. At the 4th year committee meeting, if the student has not already submitted or published a first-author paper, the student should be prepared to discuss a plan for submission of a manuscript.
    vi. If the committee meeting is a 6-month meeting, where the student is proposing that the committee will give them approval to schedule a defense of their doctoral dissertation, the report to the committee will be more detailed. Here, the student should submit an outline of their dissertation document including subsections to be included in Introduction and Discussion sections and the Data chapters to be included. Because

submission of at least one Data chapter is required to schedule a defense, it is expected that at this point, the punchline of the paper is known and there is a defined plan to complete the remaining figures without the need for new assay development and excessive troubleshooting.

3. This report should be shared with your PI at least 7 days prior to the meeting, edited as needed, and sent to the committee at least 3 days prior to the meeting.
4. Prepare a presentation with an outline similar to your report.
5. Depending on your PI's preference, you should practice your presentation with your peers in the lab, senior members of the lab, and/or your PI.

During the committee meeting

1. At the start of the meeting, the student is asked to wait outside so the committee can discuss priorities for the available time. The chair (PI) should keep track of the time and allow for time to complete the rubric and for discussion with the PI absent.
2. The student delivers an oral presentation of their research progress and future plans. When possible, papers should be outlined. For a 6-month meeting, an outline of dissertation chapters should be presented.
3. At the end of a meeting, the student is asked to wait outside while the committee, including the PI, completes a rubric to document progress and highlight concerns or achievements (Appendix F). This rubric will be submitted to the student, the GPD, and the Biology Graduate Office. In rare circumstances of high concern, this rubric can be used to initiate a probationary period in coordination with the GPD, the DGS, and the College.
4. After the rubric is completed, the student is invited back to receive feedback from the entire committee, including the PI.
5. The PI is then asked to leave and the student is given the opportunity to talk with the committee about anything they would prefer to talk about without the PI present.

What to do after a committee meeting

1. Consider the feedback in the committee meeting rubric and any notes taken by you and/or your PI. Summarize committee comments in post-committee meeting document.
    a. Limit: 1-2 pages
    b. Your report should include a short 3-4 sentence summary of progress you reported and indicate difficulties encountered. Include what key suggestions were made by your committee.
    c. Indicate whether you completed an IDP and discussed it with your PI and/or committee.
    d. Label your PDF file: NAME_post-committee meeting report_YEAR
    e. Get report approved by your advisor
2. Send post-committee meeting report to your PI and your committee.

Appendix H. Preliminary exam protocol

Objectives of the Exam

The preliminary examination (prelim exam) is a significant milestone in the Microbiology graduate program. Exam committees must evaluate whether graduate students are prepared and qualified to carry out their dissertation work including sufficient understanding of core concepts and information relevant to their broader research area. The experience should bolster a student's knowledge base and key competencies in creativity, adaptability, resourcefulness/self-learning, analytical skills, critical thinking, and written oral communication skills. Thus, students should ideally emerge more confident in their dissertation plan and in their ability to carry it out.

Roles

Examinee. A student in the Microbiology graduate program, typically in the summer between their 2nd and 3rd year, who will take the prelim exam towards Ph.D. candidacy.

Research advisor (principal investigator; PI). The student's Ph.D. mentor. It is expected that the PI will interact with the student regarding the research proposal direction. However, the PI, and anyone else that the student consults with, must prioritize exam integrity at all stages. The PI should communicate these expectations to the student and lab members if needed. The research proposal must be a product of the student's efforts and should reflect the student's thoughts and writing abilities. The responses to the 6 knowledge questions cannot be guided nor edited by the PI. However, it is recommended that the student show the questions and responses to the PI after submission since they could impact the research direction. The PI has the option to attend the oral exam as a witness but must remain silent.

The advisory committee. The advisory committee is comprised of the student's PI and 3 other members chosen by the student in consultation with their PI and agreed to by each committee member. At least one non-PI member must be chosen from the Microbiology Core Faculty. The PI serves as Committee Chair in all regards **except** those pertaining to prelim exam.

The exam committee. The advisory committee, minus the PI, with one member replaced by an outside examiner. Each member assesses and provides feedback on the proposal, provides 2 questions to probe student knowledge and assesses the responses, and orally examines the student. In response to student requests, members can clarify knowledge component questions in a way that will not compromise the exam. For example, examiners cannot provide feedback on draft responses to the knowledge questions prior to submission; this would be considered assessment rather than clarification.

Exam chair. An advisory committee member chosen by the GPD to oversee the prelim exam for a given student. The chair must be a core Microbiology section member. The chair cannot be the student's PI nor the outside examiner. The GPD can only serve as exam chair if no other options are available. Chair duties include, (i) collecting proposal feedback and the 6 knowledge questions from the exam committee, (ii) requesting adjustments from the exam committee members to address breadth, appropriateness, challenge, and redundancy of the questions if needed (iii)

sending the feedback and questions to the student, (iv) mediating the oral exam, and (v) communicating exam decisions to the student, PI, GPD, and Assistant DGS.

Other exam committee members. Members can include advisory committee members from other sections/departments and the GPD. All members will work with the exam chair as necessary to adjust questions.

Outside examiner. A member of the core Microbiology faculty that is not part of the student's advisory committee, assigned by the GPD to serve as an examiner. The outside examiner replaces one of the advisory members. The outside examiner cannot chair the exam.

Microbiology Graduate Program Director (GPD). The GPD assigns exam chairs. The GPD also coordinates communication with the appeals committee, Assistant DGS, and DGS as needed. The GPD should be kept informed on issues of importance regarding individual exams but need not be CC'd on every email (e.g., do not include the GPD on exam scheduling threads).

Director of Graduate Studies (DGS). Anyone acting in the capacity of the DGS will typically only be involved in the preliminary exam in the event of an appeal or plagiarism allegation.

Assistant Director of Graduate Students (formerly the graduate advisor). The Assistant DGS maintains a record of exam outcomes, communicated via the exam chair and/or GPD. Otherwise, the Assistant DGS need only be CC'd in the event of an appeal or plagiarism allegation.

Appeals committee. Three core members of the Microbiology Graduate Program assigned by the GPD or DGS to perform duties described in the appeals process. The composition excludes the GPD, PI, DGS, and exam committee. The committee has the option to remain anonymous.

Other document reviewers. Students can seek feedback on both the proposal and knowledge questions from peers and other individuals other than the PI and exam committee. However, in such cases, the students should make it explicitly known that the documents are part of an exam, and as such, any feedback should prioritize exam integrity and ensure that the examinees voice and opinions are maintained (e.g., reviewers might point out what parts of the documents were confusing and why and point students to articles or research groups that might have been overlooked). Students that lean heavily on edits and opinions by others will jeopardize their performance in the oral exam, which will primarily assess individual understanding.

Artificial intelligence. IU can consider the submission of content generated by artificial intelligence (e.g., ChatGPT, Google Translate, etc) to be academic misconduct. However, some uses are allowed. Refer to the most recent Microbiology program AI usage guidelines and talk to your PI and examiners if you are uncertain about ethical boundaries **before** submitting a document.

Timeline

The preliminary exam must be completed prior to the end of October of the student's 3rd year. Most students will take the exam in the summer between their 2nd and 3rd year in graduate school. Students who switched labs, and might have had insufficient time to collect preliminary data to support their proposal, can request an extension from the GPD, in consultation with their PI and committee.

Students should not wait until exam preparations to generate preliminary data and to read intensively within and around their research area. Students should already be performing experiments, reading, and developing skills to improve research productivity and knowledge.

The following schedule is intended to accommodate vacations, conferences, moving, etc. Students and faculty must adhere to this schedule. Barring exceptional circumstances, no extensions will be granted. The schedule uses 'due by' dates. If a student and committee are inclined and proactive in communicating desires, the exam can be completed early in the Summer. For example, if the student and PI feel that the proposal developed during Z620 grant-writing does not require edits, it can by submitted in early May and the committee could provide feedback and 6 knowledge questions shortly thereafter, depending on individual schedules. Students must be allowed a minimum of 4 weeks to revise/rewrite proposals and respond to knowledge questions. Students can submit documents within 4 weeks but they must not be pressured to do so.

Year 1 (Semester 2)

Spring, summer — Advisory committee formed. GPD and the Biology Grad Office notified.

Year 2 FALL (Semester 3)

Sep – Nov — First committee meeting held before 4th week of November.

Nov/Dec — GPD assigns exam chairs and outside examiners.

Year 2 SPRING (Semester 4)

Jan – Apr — Student drafts a research proposal during the BIOL-Z 620 grant-writing.

Year 2 SUMMER/FALL (Semester 5)

May — Student revises proposal.

By June (1st workday)

Student submits proposal (NOT a draft) to the exam committee + PI.
Student can schedule an oral exam at any point in the process.

By Monday of last full-week of June

Exam chair sends a REJECT/PROCEED decision, comments, rubrics, and knowledge questions to the student and the GPD. Student should schedule their oral exam if they haven't already.

By 1st Friday of August (intended to allow ~5 weeks and before the Phages meeting)

Revised/rewritten proposals are due. Answers to knowledge question are due.
Revised/rewritten proposals will not receive detailed feedback but are instead assessed on the oral exam rubric.

Up to September 30 — First oral exams held. Exam committee cannot deliver same-day decision but must deliver a decision within 3 working days.
In the event of a failed oral exam, the student has one month to prepare for a retake if the option remains.

October 30 — Last opportunity for oral exam retakes

Exam format

The exam has (i) a written research component, (ii) a written knowledge component, and (iii) an oral exam that can cover both components. Each document must be the student's own work. **Plagiarism will result in dismissal from the Ph.D. program** (see 'Academic Misconduct' section). Students who are unclear on what constitutes plagiarism should seek advice from their PI and/or Grant Writing instructor and/or committee prior to submitting the proposal.

(i) RESEARCH COMPONENT

Developing the ability to plan and conduct thoughtful, rigorous, independent research is the core goal of the Microbiology doctoral program. As a means of assessing a student's progress towards this goal, this exam component involves the formulation and presentation (written and oral) of a research proposal outlining the student's dissertation research.

Students write a research proposal adhering to the format below. Students will have received assistance in formulating this proposal through the Z620 Grant Writing class, usually taken in their 2nd year. Most students will continue working on the proposal after this course. Students should both seek and receive further assistance from their PI and other scientists on the research direction.

Research proposal format:

The proposal will follow an NIH R21 proposal format, with the following exceptions:

- 11 point/Arial/ 0.5 inch margins throughout. Figure legends can use arial font, size 9.
- Number pages at the bottom. Number lines continuously in 6 point type
- Double space instead of single space

Sections.

- Title page: 1 page
- Project narrative: 2- 3 sentences
- Abstract/Project summary: One double spaced page. No citations
- Specific Aims: 2 pages double spaced. Usually 2, but no more than 3, specific aims. Citations optional.
- Research Strategy/Approach: Citations required. 12 pages double spaced including all figures, but not references, organized with the following sections:
  a) Significance
  b) Innovation
  c) Research Plan, including the following sections.
  d) Timetable (brief)
  e) Background (a general background can be given, or a background can be included for each specific aim)
  f) Preliminary Results (preliminary results can be combined into one section or included for each Specific Aim)

For each Specific Aim, explicitly indicate a hypothesis/question(s), rationale for the choice of experiment(s), experimental plan, expected results and interpretations, pitfalls and alternative approaches, and future directions if applicable.

- References: No page limit, but usually <10 pages double spaced. Use Journal of Bacteriology or Journal of Virology (ASM) format.

Evaluation of the written proposal.

The proposal will be evaluated using the rubric in Appendix I. The committee will expect a well-written, compelling, and well-reasoned/researched proposal. Committees should be able to easily identify what you are trying to do (e.g., what is the question/hypothesis being addressed by each aim/experiment) and why (e.g., justification for pursuing a given question/hypothesis). **Examiners must provide specific comments in a manuscript/grant review format in addition to the rubric.**

Outcomes of evaluation of written proposal

The exam chair will collect rubrics, comments, and knowledge questions and reach a consensus with the committee on a REJECT/PROCEED decision before the deadline. The chair then communicates the decision and sends the documents to the student and PI.

a. REJECT***.** The proposal is unacceptable (e.g., writing is incomprehensible, severe flaws in logic, addresses questions that have already been answered, etc). The student rewrites the proposal. A reject decision counts as 1 of 2 possible fails (the rewrite is a retake of the exam). The student also completes the knowledge questions and proceeds to the oral exam.

b. PROCEED – The student's proposal is acceptable within one of two categories:
Accept. The proposal requires no further edits.
Modify*. The proposal requires modification.

In all cases, **the student should schedule their oral defense** if they haven't done so already. Oral defenses, including retakes, must occur before October 30 of the Fall of the 3rd semester. Because this timeframe includes retakes, it is expected that the oral exam will occur before Sept 30 to allow time to prepare for a retake, if needed. It is expected that most students will defend in the Summer.

***If a rewrite (reject decision) or modification is requested**, the revisions should address reviewer comments. The deadline for revisions is the same as that for the responses to the 6 questions. The format and the length of the rewritten/revised proposal must conform to the original proposal guidelines. **Detailed written feedback will not be provided on revised/rewritten proposals but the new proposal will still be assessed as part of the rubric at the oral exam and so must be taken seriously.** In addition to (i) a clean proposal, the student should submit a (ii) marked-up proposal (track changes shown; e.g., use the Compare Document tool in Microsoft Word after revisions are complete), and (iii) a stand-alone ≤ 2-page document (single-spaced, Arial 11, 1" margins) that concisely explains the major changes and/or justifies deviations from reviewer suggestions (iv). This document, and the knowledge component responses (below), cannot be used to supplement proposal content; the proposal must be a stand-alone document.

(ii) KNOWLEDGE COMPONENT.
Advancing scientific knowledge invariably leverages past discoveries. This portion of the exam assesses a student's ability to demonstrate, through written and oral communication, resourcefulness

in establishing a knowledgebase and to analyze and make critical connections between distinct sources of information to efficiently address the unknown.

After reviewing the research proposal, each committee member drafts 2 questions (6 total). The committee has discretion in the types of questions or topics that they feel would benefit the student by studying either within or separate from the proposed research. For example, some questions can ask students to synthesize rather than summarize, and/or to give justified opinion(s), and/or design experiments based on a hypothetical case study. Some questions might refer students to specific papers or figures. It is expected that half of the questions will send the student outside of their wheelhouse in a manner that could conceivably benefit their research. If necessary, examiners can ask the PI about knowledge gaps and appropriateness of breadth (e.g., what other labs should the student be monitoring). Approval of questions is up to the exam chair. The exam chair can request modifications or suggest consolidation as needed (e.g., challenge level; redundancy, etc).

Students have a minimum of 4 weeks from receiving the questions to craft written responses; responses can be submitted sooner but committees cannot demand a student to do so. Concise responses are encouraged. Care should be taken in how responses are crafted (e.g., how would the information be best communicated: broad overview followed by specific examples? Most reliable experimental approach followed by alternatives with caveats?). Responses must be properly cited. Where relevant, students can and should paste, **cite**, and refer to key figures from primary literature to demonstrate an understanding of how discoveries were made.

Knowledge component response format:

- Arial 11 pt font, 0.5 inch margins, double-spaced; reference section can use 10 pt font
- All 6 responses should be compiled **in a single document**
- Each response:
    - should include the original question
    - should be ≤ 2 pages double-spaced, excluding figures and legends
    - should have a references section, which does not count towards the page limit
    - can have an additional ≤ 1 page of figures and double-spaced legends

(iii) ORAL EXAM.

The student and the exam committee will convene on the agreed-upon defense date. The student should reserve a room for no less than 2.5 hours. Prior to the defense, the student will be asked to step out of the room and the committee will confer on issues of greatest importance to be evaluated. The PI will already have provided assessment of the student as indicated on the rubric.

The student will be invited to rejoin the committee and the student will give a ≤ 20 min presentation of their proposal. Interruptions are discouraged unless clarification is necessary. Each examiner then has ≤ 30 min uninterrupted to ask questions. How time is distributed between examiners and topics can be flexible. Each examiner can devote time to knowledge and research components as they deem most useful; it is possible that knowledge and research questions could intersect. It is also possible that some questions/aims won't be covered. Time permitting, other examiners can ask follow-up questions as per the chair's discretion. However, the chair should ensure (e.g., using time limits) that questioning is not dominated by one examiner or one topic. Anyone in the exam, including the student, can request a brief recess from the chair.

During the oral defense, the student should expect to (i) place their research in the appropriate context within the field, (ii) demonstrate excellent background knowledge, (iii) justify their choice of experiments, (iv) demonstrate awareness of potential experimental shortcomings and provide alternative approaches, and (v) engage in constructive scientific discussion with the committee. The student can change their responses and opinions from their written documents during the oral exam. Examiners can assess whether changes are favorable (e.g., coming to a deeper understanding through discussion) or concerning (e.g., coaxing needed for a student to understand what they wrote). The PI can choose to be present for the oral defense but will remain silent. The chair or any other committee member can temporarily adjourn the meeting and ask the PI to remain silent. In extreme circumstances, the PI will be asked to leave.

The meeting will conclude when each examiner has asked their questions within their allowed time. The student and the PI then leave the room. The PI does not provide their thoughts on the student's performance during the defense. Each examiner evaluates the student using the 2nd rubric (Appendix I). For the knowledge component, each examiner is only expected assess responses to their own 2 questions. However, comments can be given on the other questions, including perceived inaccuracies, disagreements, miscommunication, unfairness, or unprofessional conduct from the examiner and/or student. **The committee has 3 working days to consult with each other and arrive at a pass/fail decision**; next-day decisions are allowed but same-day decisions are not. The exam chair communicates the decision and the rubrics to the student, PI, GPD and Asst DGS.

Oral exam outcomes

A student must demonstrate satisfactory ability in both the knowledge and research components of the exam.

a. **Pass.** The student's performance is adequate. The student will have officially progressed to candidacy for a doctoral degree once all course requirements have also been met and the proper documents filed (page 6). The exam chair's responsibilities are now over, and the chair of the advisory committee reverts to the PI.

b. **Fail.** The student's performance is inadequate. A failure can result for several reasons but will most likely result if there is a deficiency in background knowledge and/or understanding of the project. For example, a proposal can be flawless or it can have flaws, but it is problematic if the student cannot explain the reasoning behind chosen experiments or work with the committee to recognize flaws and propose alternatives.

Oral exam retakes. If the student previously received a REJECT decision, then an oral exam retake is not allowed. If a failure on the oral exam is the student's first failed attempt, then the student can retake the oral exam by the end of October (see timeline). The retake should focus on the deficiencies noted in the rubric. An oral exam retake will not include rewriting responses to the 6 questions nor proposal revisions. The student should notify the GPD and their committee whether they will retake the exam within 7 days of the 'fail' decision. The student is encouraged to consult with their PI and their committee in making this decision.

Two fail decisions will result in dismissal from the Ph.D. program. Students exitting the Ph.D. program may be admitted to a Masters program on a case-by-case basis (Appendix O). The decision to transition should be communicated to the GPD within 2 weeks of a 2nd fail decision. Documents

for transitioning to the Masters program should be submitted within 2 weeks of the decision to transition. If the student feels that there was a procedural flaw in the exam process, the student may submit a written petition to the GPD, the Assistant DGS, and the DGS.

Appeals process

1. Student consults with their PI, and others if necessary (e.g., GPD, committee), and informs the GPD of their intent to submit an appeal **within two weeks** of the fail decision. An appeal can only be filed if no retake option remains.
2. Student writes a $\leq$ 500-word appeal explaining the procedural flaw that resulted in the incorrect evaluation and submits the document to the GPD, the DGS, and the Assistant DGS. This document must be submitted **within three weeks** of the fail decision.
3. DGS or 'neutral' member steps in if the GPD was an examiner or if there are other concerns.
4. GPD/DGS assigns an appeals committee (see notes on committee above).
5. The committee reviews the alleged flaw described in the appeal. The committee can consult with the exam committee and the student if they wish to reveal their identity. Alternatively, the committee can communicate via the GPD if they have questions but wish to maintain anonymity.
6. The committee arrives at a decision. The councilor provides a short, written explanation of the decision to the GPD, who then forwards to the PI, student, DGS, and Assistant DGS.

The outcome depends on the nature of the appeal and is ultimately up to the committee. For example, depending on what stage the alleged procedural flaw occurred and the interpretation of the committee, a successful appeal could warrant a redo of the entire exam or reset to the stage where the flaw occurred.

After the conclusion, the appeal request and the committee response is shared with core faculty to serve as precedent on subsequent exams until overturned by faculty vote.

Appendix I. Prelim exam rubrics

WRITTEN PROPOSAL RUBRIC

Student _____DATE:_____

Examiner_____

For first proposal submission. Revised/rewritten proposals are assessed using the oral exam rubric. Comments should be consistent with the score. Additional specific comments **are required** in a manuscript/grant review format. **Students and PIs receive all feedback on this form.**

	Score	General comments:
Clarity. Written to be understood. Explicit question/ hypothesis. Logical narrative.		
BACKGROUND AND IMPORTANCE		
Overarching Question/Hypothesis/Problem. Easily identified; unambiguous.		
Background and importance. Relevant and sufficient. Supported by literature.		
Preliminary data supports the research direction or goals		
APPROACH		
Experiments address a question/hypothesis. Easily identified; unambiguous.		
Experimental design. Logical, achievable, justified, prioritized, has controls.		
Outcomes. Reasonable, justified, relevant.		
Caveats. Demonstrates understanding of methods.		
Context. Ability to look forward; identify contributions to the field.		
Formatting. Page limit met, deadlines met.		
TOTAL	/100	

*Score: 9-10 – above average; 7-8 – adequate; 5-6 – below adequate; 1-4 – poor
* At the evaluation committee's discretion, a single low-ranking category could result in failure.

SPECIFIC FEEDBACK. Concisely provide feedback as you would for a manuscript or grant review. Track changes on the proposal are optional.

ORAL EXAM RUBRIC

Student_____ DATE:_____

Examiner_____

Students and PIs will receive all feedback on this form.
Some of the rubric can be filled out ahead of time.

	Score	Comment:
Mentor's view. Student's effort and understanding of project. #		
Research component (written)		
Revision quality. Properly addressed comments from first proposal.		
Knowledge component (written)		Examiners need only assess responses to their questions.
Justification. Grounded in cited facts.		
Writing clarity. concise vs wordy; clear vs vague		
Formatting criteria Page limit met, deadlines met		
Oral exam of both the research and knowledge components.		
Understanding of field, methods. Based on discussion.		
Understanding of project direction and importance.		
Opinions and synthesis Grounded opinions, makes logical connections/predictions		
Committee engagement Capable of informed discussion; works with committee		
TOTAL	/90	

*Score: 9-10 – above average; 7-8 – adequate; 5-6 – below adequate; 1-4 – poor
* At the evaluation committee's discretion, a single low-ranking category could result in failure.
# **Mentors should provide a score and comment to the committee ahead of the exam** to be pasted into this rubric without reinterpretation by the examiners. All other categories are determined independently from the mentor.

Appendix J. Microbiology internship policy.

Many companies offer internships to help recruit students after graduation. Internships are an excellent opportunity for students interested in the private and government sectors to explore potential employers, build their network, and determine if a specific career path is right for them. However, internships necessarily take time away from the bench, as students are rarely allowed to continue their doctoral research work during the internship. Therefore, to ensure that students stay on track for graduation, the Microbiology training program offers the following guidance to both students seeking internships external to IU and to their faculty mentors:

- Discuss the possibility of conducting an internship early – ideally *before* a student joins a lab. Make sure the PI and the student have clear expectations. The PI needs to be fully on board with the idea of a student potentially taking on an internship.

- Students must have finished their preliminary exams and have their first research paper ready to submit for peer review. Ideally, students should be ABD (all but dissertation).

- Prior to starting an internship, the student must provide the Microbiology graduate program director with a one-page document addressing the issues described below (see template attached). The document must be signed by both the student, PI, and Microbiology graduate program director.

    - **Internship funding** normally comes from the companies/organizations recruiting the student and the PI should not be expected to fund the student during their time away from the university. If the internship period spans only a portion of the semester, the student and PI must come to an agreement as to how to fund the remainder of the semester. The College has a limited number of full and partial-year (including summer) Graduate Pathways Fellowships available to qualifying PhD students. The Walter Center (see here) also offers financial support.
        - Regarding support promised in offer letters (5 years), Biology presently will not count a fall or spring semester internship against the promised timeline of support. Eligibility for support via SAA-AIships would follow normal Biology policy. However, internships during the summer will not increase eligibility for additional support from Biology; Biology and individual advisors will not be responsible for ensuring the promised annual stipend is met in the case of summer internships.

    - All PhD students are required by the College/UGS to maintain **continuous enrollment**, either via G901 (if eligible) or a minimum of 1 credit of M800 or equivalent (must be paid for by the student/internship provider). This enrollment also enables the College to find ways to supplement stipends, route insurance, etc. Students cannot take a leave of absence for an internship.

    - The student should identify ahead of time how their **health insurance** will be covered – this may be through COBRA extension bought by the recruiting company. Coverage from an SAAship during spring could extend during summer. However, an internship in spring would not receive SAA insurance (eliminating coverage for

spring and summer). IU's Fellowship insurance for graduate students (link for DGS/GPD/Grad Staff) could be purchased.

- Both student and PI should recognize that an internship will likely lengthen the **time to degree** and should make plans to account for possible delays. Both parties must agree on expectations for completing the PhD degree following completion of the internship.

- The student must discuss with their Advisory/Research Committee how the internship will impact '**satisfactory progress**' toward degree completion. The Committee then should describe, in their committee meeting report, how the internship factored into the annual evaluation.

- **International students** interested in internships may need a letter of support from the Office of International Services due to visa considerations. A letter from the PI to OIS that explains how the internship is vital to the dissertation may be all that is needed, but responsibility will fall on the student to ensure all visa requirements are met.

If you have any questions about this policy, please contact your graduate program director.

MEMORANDUM OF UNDERSTANDING

During the ____ Semester of 20__, _____, a student in the Microbiology program at Indiana University, will participate in an internship at _____. The internship funding will come from the company/organization recruiting this student and their PI is not expected to fund the student during their time away from the university. However, as the internship spans only a portion of the semester, during the time period from ___ to ____ the student will be funded using the following mechanism:

It is understood that this internship will likely lengthen the time to degree for the student. After completion of the internship, the student is expected to meet the following goals and timeline:

Student _____ (Full name) Student _____ (Signature)

PI _____ (Full name) PI _____ (Signature)

GPD _____(Full name) GPD _____(Signature)

Appendix K. Procedure for scheduling and defending a doctoral dissertation

1. Identify a date where your entire advisory committee will be available for your dissertation defense. This must be done before your defense is announced by the University Graduate School (UGS). It is best to start this process as soon as the committee agrees that you are ready to write and defend your thesis (*i.e*. immediately after the 6-month meeting)
2. Ensure that a room is available both for your dissertation defense public talk and the post-presentation defense to the committee. When possible, Microbiology students should schedule their public defense talk during a regularly scheduled research presentation such as "Microphiles" which is held on Fridays at 12:40 PM.
3. UGS requires that your dissertation defense announcement is made through them at least 30 days in advance. The procedure to make this announcement is described here.
4. The UGS has specific requirements for formatting your dissertation document. The student should carefully read and follow these instructions.
5. The student should discuss with their mentor an acceptable timeline for providing a draft of the dissertation document.
6. The student should submit a draft of the dissertation document to their mentor for reviewing and editing at least 60 days prior to defense. It is the responsibility of both the student and mentor to meet this deadline. In many cases, the advisor will request that the dissertation be submitted to them chapter by chapter.
7. The mentor should submit an approved dissertation document to the entire committee at least 30 days prior to defense (note that this deadline is a UGS deadline and a committee member reserves the right to refuse to be present for your defense if this deadline is not met). The student should be cc'd this email.
8. The student will not be allowed to defend without timely submission of a complete dissertation document.
9. Defend your thesis.
10. Incorporate corrections and suggestions provided by the committee, if this has not been done prior to the defense.
11. Obtain signatures on cover page
12. Submit dissertation to UGS using the procedure described here.

Appendix L. Format for a Microbiology Ph.D. dissertation

Each doctoral dissertation must meet the formatting requirements set by the University Graduate School (UGS). Keeping these requirements in place, each Microbiology graduate student writing their doctoral dissertation should include these sections in their dissertation.

1. Title Page
2. Acceptance Page
3. Abstract
4. Table of Contents
5. Introduction

This chapter should present an overview of the field in a way that sets up the rationale for the students' thesis research. Recommended length for this section is ~12 pages of double spaced text. The background should be appropriately referenced.

6. Data Chapters

As indicated in the minimal requirements documents, each doctoral dissertation must contain at least one data chapter containing research that is ideally, already published or at least submitted as a first author publication by the student. We expect that most doctoral dissertations will contain at least three data chapters, each of which will equate to a publication in the immediate or near term.

Each data section should contain a short introduction, materials and methods (sufficiently detailed to be useful to future laboratory members), results, discussion and references. All data chapters should contain publication quality images and figure legends.

If the student includes data from a submitted, in press, or published manuscript that also contains work performed by other laboratory members or members of collaborating laboratories, the student should clearly state how they contributed to the study (i.e., indicate which experiments were done by the student, whether the student contributed to the writing, analyses, etc).

7. Conclusions and future directions

This chapter summarizes the contribution of a student's work. This section should discuss how their contribution changed the field and impacted the line of study. It should identify new questions that were raised by their contribution. Finally, future directions that are of interest and can be pursued by other members of the laboratory should be identified and approaches that may be taken to pursue these directions should be discussed. Recommended length for this section is ~10 pages of double spaced text. The section should be appropriately referenced.

8. Appendices

If the student has obtained data that are interesting and potentially useful to the laboratory but are too preliminary or do not pertain to the main subject of the doctoral dissertation, they may be included in this section using the format of the other data chapters.

9. Student CV.

Appendix M. Guidelines for Advisor-Graduate Student Interactions in the College of Arts and Sciences, Indiana University (*Revised September 2, 2020)*

Much of this document is copied or adapted from a website at Penn State: https://science.psu.edu/future-students/graduate-students/guidelines-and-policies

*Lab-specific student/PI expectations (lab culture statements) are included in the shared OneDrive folder.

The success of every graduate student in the College of Arts and Sciences depends in part upon the role of the student's advisor. Whether they work together in a lab or a research team, meet in a seminar, or consult periodically in office hours or online, the advisor and the student together establish a plan for the graduate student's research, work to identify and remove obstacles to success, and ensure that the student has opportunities to develop professional experience. Most of these interactions take place outside the classroom, often in informal interactions. To ensure that these interactions are as productive as possible, the College offers these guidelines.

These guidelines embody many of the best practices used by other institutions and professional societies. * They are intended to provide principles for establishing an effective and productive advisor-student relationship that relies on trust, courtesy, clear communications, and shared expectations. These College guidelines provide a general framework for interactions; departments and programs are expected to establish and document more detailed implementation in departmental handbooks and procedures. These guidelines supplement the IU Student Code, which addresses primarily formal academic matters, by attending to the faculty's role in the student's research process.

Faculty Research Advisors should:

• promote an environment that is intellectually stimulating and free of harassment;
• be supportive, equitable, accessible, encouraging, and respectful;
• recognize and respect the cultural backgrounds of students;
• be sensitive to the power imbalance in the student–advisor relationship;
• set clear expectations and goals for students regarding their academic performance, research activities and progress;
• discuss policies and expectations for work, either as teaching assistants or research assistants, including work hours, vacation time, and health contingencies;
• establish mutually agreed upon expectations for frequency and format of communication that will provide students with regular, clear feedback on research activities, performance, and progress;
• promote and manage productive and collaborative relationships for students working in large research groups and collaborations;
• provide students with training and oversight in all relevant aspects of research, including the design of research projects, the development of necessary skills, and the use of rigorous research techniques or procedures;
• provide and discuss clear criteria for authorship at the beginning of all collaborative projects and revisit authorship throughout project development as contributions may change;
• foster a safe work environment by discussing and mitigating potential hazards associated with a student's research activities;
• encourage participation in professional meetings and try to secure funding for such activities;
• ensure students receive training in the skills needed for a successful career in their discipline, including oral and written communication and grant preparation as appropriate;

• recognize that some students will pursue careers outside of academia and/or outside their research discipline and assist them in achieving their chosen career goals;
• be a role model by acting in an ethical, professional, and courteous manner toward other students, staff, and faculty.

Graduate Students should:
• recognize that they bear the primary responsibility for the successful completion of their degree;
• complete all tasks assigned by the department, including teaching, grading, and other assistantship responsibilities;
• know the policies governing graduate studies in the department and the graduate school and take responsibility for meeting departmental and graduate school deadlines;
• be proactive in communicating with the advisor and research committee about progress and challenges associated with research and program trajectory;
• recognize that in addition to their role as a student, they have rights and responsibilities as employees of the university, and expect that these are clearly conveyed to them;
• clearly communicate with their advisor(s) regarding their career preferences and any changes to them during the course of their program;
• be proactive about improving research skills, including written and oral presentation;
• be proactive about teaching professionalization and preparation through exploring workshops and training opportunities;
• seek out appropriate professional service opportunities and take advantage of career planning support in the Walter Center for Career Achievement;
• participate actively in departmental activities such as colloquia, brown-bags, reading groups, etc.;
• seek mentoring and support resources beyond their faculty advisor(s), including other faculty members and peers as well as individuals external to the university;
• inform faculty advisors of potential and/or existing conflicts and work toward their resolution, following departmental guidelines;
• obtain outside help from ombudsmen, graduate chairs, or other faculty if conflicts arise with their advisor;
• be aware that if they feel compelled to change advisors or research direction, they have options and should consult with their advisor, other mentors, or department officers, recognizing that such options may include changing programs;
• always act in an ethical, professional, and courteous manner toward other students, staff, and faculty, respecting the value of their time and responsibilities.

Departments and Programs will:
• provide students with up-to-date information that includes policies, practices, resources, degree requirements, and expectations for progress;
• assist students with selection of their advisors as needed, providing general guidance on expectations for effective mentoring;
• ensure that all students have a faculty member with responsibility for advising them;
• proactively monitor graduate student progress toward their degrees and professional development, including mentoring meetings, committee meetings, exam completions, and other benchmarks toward the degree. Opportunities should be provided to examine the effectiveness of the student-advisor relationship and offer advice on addressing issues that arise.
• provide students and faculty with contacts, resources, and a clear process for potential conflict resolution (e.g., ombudsperson, director of graduate studies, or department head). Interdisciplinary programs are responsible for coordinating among the home departments of faculty and students.

• assist students who wish to change advisors or research groups in identifying new advisors within the department or program who are receptive to accepting the student, and advising the student on options should no placement be found;
• provide appropriate infrastructure to allow students to complete their education and research in a timely and productive manner;
• provide opportunities for professional development that will be relevant to students seeking careers outside academia and/or their research discipline;
• promote an environment that is intellectually stimulating, safe, and free of harassment;
• provide students with contacts for campus resources that promote health and wellness;
• incorporate these guidelines and recommendations into their departmental policies or handbooks and actively promote their observance.

Appendix N. Transfer credits

Visit: https://biology.indiana.edu/student-portal/graduate/credits-transfer.html

Appendix O. Procedure for transfer from PhD. To Masters

Changing from a Ph.D. to a Master's degree requires approval via the following:

1) You must have completed the necessary coursework and have identified an advisor and two faculty members who will serve on your advisory committee.
    a) If you plan to change to labs, you will need to submit a detailed proposal and justification for the change.
    b) Biology requires 3 committee members to serve on a Master's committee (PI plus two others). Membership is internally tracked. Hence, committee membership can change without filling out administrative forms with UGS or CGO. Three members, including the committee chair, sign the 'acceptance page' for UGS upon filing a Master's thesis.
    c) Courses are valid for 5 years for those in a MS program.
2) Complete a "Request to Transfer from Ph.D. to Master's Degree" form (available from the Biology Graduate Office) that is signed by you, your thesis advisor, and members of your thesis committee. Submit the form to the Asst Director of Grad Studies (biogrdav@iu.edu), the GPD, and the Director of Graduate Studies (DGS) (biodgs@iu.edu).
3) Submit a letter (electronic acceptable) to the DGS (CC the Assistant DGS and your GPD) requesting permission to transfer to the Master's degree. The letter should describe the reasons for request and if you plan to change labs, include a justification and a brief project proposal including the expected date of completion. You should discuss the proposed research plan and its timing with your committee or, at the very least, your PI.
4) Your Master's advisor must submit a letter (electronic acceptable) to the DGS, the Asst Director of Grad Studies, and the GPD stating that they will serve as the advisor until completion of the degree and indicate if current progress is consistent with the expected date of completion.

The DGS and the GPD review the request. The GPD of the program you are transferring to will need to verify that you are on target with your credit requirements. If the request is approved, the DGS will inform the College of Arts and Science that your degree goal has changed. If the request is not approved, you will not be allowed to continue in the program. The DGS will lay out the specifics of

future support. Support will be granted solely on the availability of AI positions unless your PI will support you on a grant. Support is not guaranteed. Contact the Asst DGS regarding AI position availability by Oct 1 for Spring classes or by Feb 15 for Summer and Fall classes.

Appendix P. Expectations of Microbiology training faculty

The primary privilege of being a Training Faculty Member as part of the Microbiology Graduate Program is to participate in the training and mentoring of Microbiology Graduate Students. This training and mentoring includes interaction with students during recruitment, if the students are applying to Microbiology, hosting rotation students during their first year, as well as placement of students in Training Faculty laboratories.

Training faculty are expected to:

- have an active research program that is deemed consistent with the training goals of Microbiology and/or adds to the strengths of the program.
- have an active grant or other funds, or reasonable expectation to obtain an active grant, to support students financially should they join their laboratory. We expect training faculty to support their students through a variety of ways including RA-ships, supporting travel to conferences, funding their research, providing financial support during the summer, and covering publication costs.
- help graduate students complete PhD and graduate in a timely manner (usually within 6 years) and help students apply for and secure extramural fellowships.
- be willing to serve on prelim committees and graduate advisory committees for students within the program.
- participate actively in the Microbiology seminar series and weekly training seminars (MicroPhiles).
- engage in service to the section, as needed, and as audited by the section associate chair.
- have a good record of retention and graduation of students, as evaluated by the DGS, GPD, and the Graduate Program Recruitment Committee.

Training faculty shall retain their appointment as long as they are fulfilling their obligations to the section and remaining in good standing. Otherwise, such faculty must be reappointed by majority vote of the faculty section.

Appendix Q. Guidance and procedure for switching labs

Introduction. When students join a lab after completion of rotations, it is assumed that students have carefully considered the pros and cons of joining that laboratory. It is also assumed that the PI has considered what it will take to serve as the mentor for the student. The program therefore expects that in most cases, the student will successfully complete their preliminary exam and remain in that laboratory until completion of their PhD. However, in some, hopefully rare cases, it is possible that the student will consider changing laboratories.

Attempting to switch labs is risky and could result in a student leaving the program if they can't find another lab (students must be part of a lab to remain in good standing). Even if a switch is successful, a lengthening of the timeline to graduation is usually unavoidable. Thus, the general expectation is that the student, PI, and/or others involved will first make a good-faith attempt(s) to address the issue at the source to explore paths to remain in the lab under improved conditions (exceptions could include cases with safety concerns or Title IX issues). Insufficient communication on the part of one or both parties is often at the root of problems leading to requests to switch labs. Problems can easily go unnoticed if they are not communicated; it is unfair to assume that the other party is aware of an unspoken problem. Even small problems have a tendency to fester and become overblown through 'thinking traps' if left unspoken.

Below are some possible challenges and associated suggestions prior to pursuing a lab switch.

1. Mentoring issues: not available, not accessible or interested, expects too much, doesn't allow enough independence/micromanaging, mentoring style is not the right one for me,

Suggestions:

- Communicate your concerns(written or verbal) with your PI. Chances are, they will want to know if they are doing something that you find problematic and will be open to exploring ways to address the issue. Offer concrete suggestions and be open to suggestions from your PI.
- Communicate with others.
    - Perhaps current/ former lab members have overcome similar issues and can offer advice.
    - Your advisory/ research committee and/or the GPD might have experience and advice related to the problems you are having. In most cases, they will encourage you to directly address the issue, but they might have advice on how to start.
    - Just having someone to talk to can help manage emotions and provide renewed perspective. Be explicit about confidentiality. *Note that Title IX issues and some safety concerns generally must be reported.
- Do not tell your PI or others that you are considering leaving the lab when first raising a problem. Raising this option at an early stage is not constructive and can unnecessarily escalate the situation. Be wary that word can sometimes get back to a PI through others and damage subsequent negotiations.
- If you and your PI are struggling to find middle ground, the GPD can ask the Office of Student Conduct to provide a trained mediator. All parties would need be on board for this option.

2. Lab environment: too many people, not enough people, people in the lab are not compatible for productive interactions, not what I was expecting.

Suggestions:

- Communicate your concerns(written or verbal) with your PI. Offer concrete suggestions and be open to suggestions from your PI as well. For example, if the lab needs more people, how can you help recruit students, provide undergrad opportunities, prioritize experiments for grant proposals, etc?
- Communicate with the personnel you are having a problem with. Sometimes it helps to directly address them about an issue; it's a good idea to inform the PI and get advice about how to constructively raise an issue with someone. Depending on the nature of the problem, it can do more harm than good to use the PI as an authority figure to raise an issue of concern.

3. Scientific misfit: don't like the research in lab, no longer like the project, change in career plans.

Suggestions:

- Communicate your concerns (written or verbal) with your PI. Offer concrete suggestions about modifying project directions or exploring alternative projects and be open to suggestions from your PI as well. Perhaps there are possible collaborations or internships that you and/or the PI could explore that would be mutually beneficial.
- If you are certain that the project, lab, or career path is not right for you, is might be possible to shorten the timeline by working towards a Masters degree in either the same lab or another lab (Appendix O). It is also possible to voluntarily leave the program altogether. Talk to your PI, the GPD, and grad office if you think one of these options is best for you.

4. Problems that fall under title IX related issues (link)

Note that all responsible employees, which includes all faculty, graduate students, and personnel that could be considered to be in a training scenario, are considered "responsible employees" following Biology's policy (which is grounded in University policy UA-01, UA-03). All responsible employees have responsibility to report Title IX concerns to the Title IX Office on campus. No one can keep Title IX concerns "confidential."

Students with Title IX concerns should voice them with their PI first. If that is not possible or desired, students should confer with a Title IX officer (liaison) in Biology. These liaisons are:

* Jennifer Tarter, Administrative Assistant to the Chair, jenjones@iu.edu
* Shana Wigington, Human Resources Representative, shwiging@iu.edu

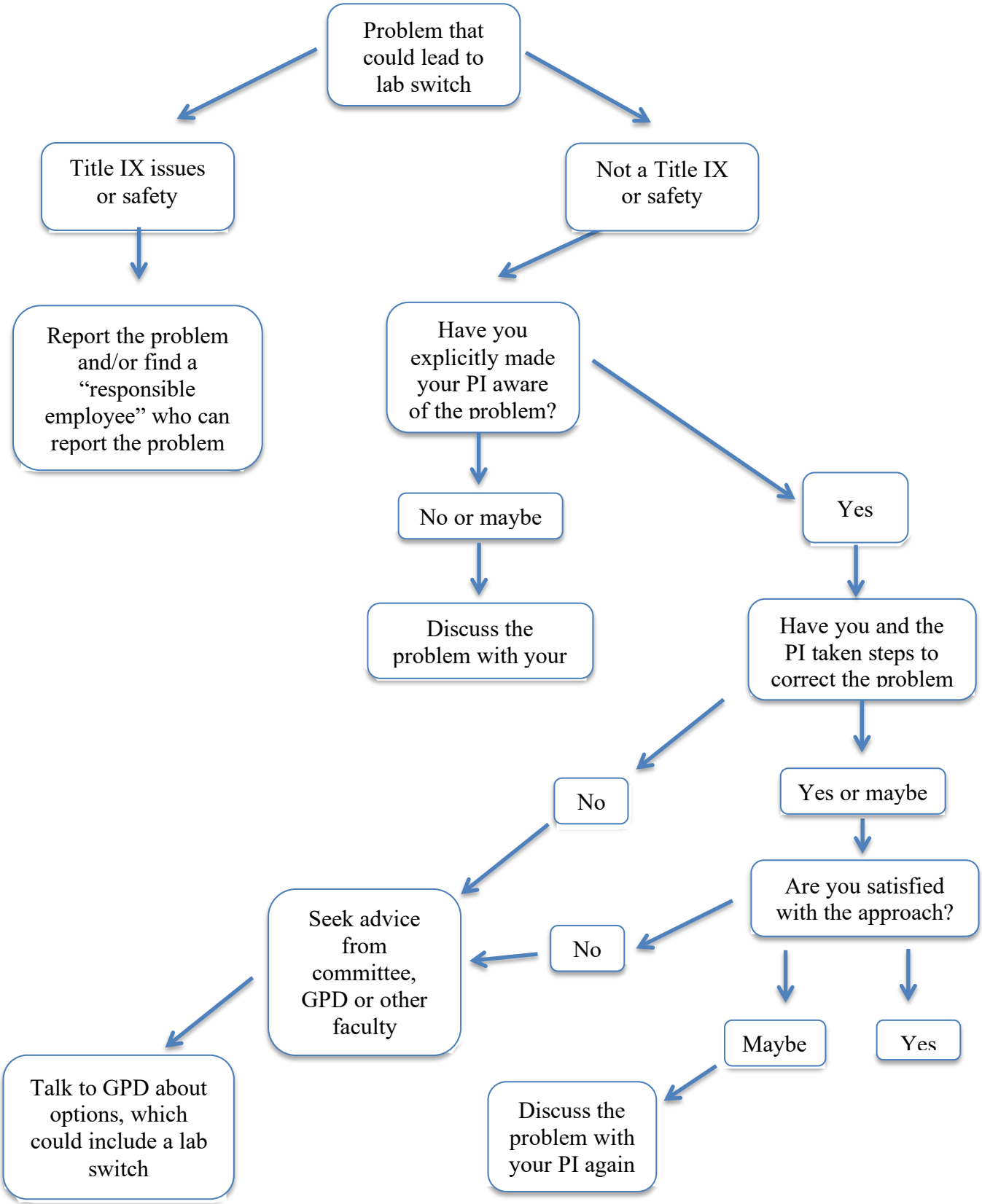
Additionally, the University has Title IX coordinators if those consultations are not possible (see here for IUB contacts). The advisor and/or Biology liaison will also consult with the Department Chair if the problem could pose a threat to others or reflect a systemic problem beyond the focal incident.

Attempting to switch labs. If you have exhausted all other options (see example flow chart below for problem with PI) and think that switching labs is the best decision, you can follow the procedure below. The procedure is designed to preserve the possibility of staying in the same lab. Note that it might not be possible to follow this procedure in all cases, for example if the PI is prematurely made aware of a student's intention to leave.

1. The student should contact Microbiology graduate program director (GPD)
2. The GPD will counsel the student on the pros and cons of changing labs.
3. The student will be made aware of the possibility that failure to secure a lab after additional rotations, they cannot remain in the program. Generally, probation will be in initiated by the time the first rotation begins.
4. If the student choses to continue the process to change labs, the GPD will determine when the current PI will be informed. This decision will be based on the conditions that have led the student to request a lab change.
5. The student will provide the GPD with names of labs that they are interested in rotating in within 1 week of deciding to initiate a lab switch.
6. The student, or GPD if preferred, will contact each potential PIs to see if they agree to a rotation with no obligation to accept the student into their laboratory.
7. Once labs willing to rotate the student have been identified, the GPD will inform the current PI of the student about the change request.
8. Following completion of an exit procedure from the current lab in a professional manner, the student will begin 5-week rotations in additional labs following the usual rotation procedure. The GPD will inform the DGS and the College Graduate Office to initiate probation.
9. If a PI is willing to accept a student into their lab following a rotation, the student is not obligated to complete other rotations
10. If the student is unable to find a lab that is willing to accept them by the end of the probationary period, the student will no longer be able to continue in the PhD program. Depending on the circumstances, the student may have to leave with no additional degree.

Maintaining confidentiality.

Faculty should not contact current mentor prior to discussion with the graduate program director. The student is advised to not discuss a possible switch with their peers until the student, in coordination with the graduate program director, has identified labs where they might rotate. Maintaining confidentiality and professionalism is in the best interest of both students and faculty.


Problem that could lead to lab switch
Title IX issues or safety
Not a Title IX or safety
Report the problem and/or find a "responsible employee" who can report the problem
Have you explicitly made your PI aware of the problem?
No or maybe
Yes
Discuss the problem with your
Have you and the PI taken steps to correct the problem
No
Yes or maybe
Are you satisfied with the approach?
Seek advice from committee, GPD or other faculty
No
Maybe
Yes
Talk to GPD about options, which could include a lab switch
Discuss the problem with your PI again

Appendix R. Microbiology program guide to the CGO's mentoring criteria

The following is a guide to how the Microbiology program addresses the 9 mentoring criteria specified by the College Graduate Office.[1]

1. **A timeline showing a typical path through the degree, milestones, and how advising/mentoring fit in**.

    - A typical timeline/checklist for the program is in the Microbiology Handbook.

2. **A distinction between discipline-specific advising and more holistic mentoring, acknowledging the need for multiple mentors for different needs.**

    - Students are assigned a faculty mentor and a peer mentor in their first semester or until they join a lab (Microbiology Handbook).
    - A detailed list of resources and personnel, including those with mentoring roles, is the subject of the Microbiology Handbook Appendix B. This list includes brief explanations of when to consult specific people both within and outside of the department.
    - Most Microbiology faculty have 'lab culture statements' that include expectations that PI's have of their students and that students should have of that PI. These statements are available to Microbiology students and faculty via a shared Onedrive folder.
    - The College's best mentoring practices are included in the Microbiology Handbook Appendix M.

3. **An outline of the roles and responsibilities of students, advisors, and departments, such as that provided by the College.**

    - This information is summarized within the Microbiology Handbook Appendix B.
    - Most Microbiology faculty have 'lab culture statements' that include expectations that PI's have of their students and that students should have of that PI. These statements are available to Microbiology students and faculty via a shared Onedrive folder.
    - The College's best mentoring practices are included in the Microbiology Handbook Appendix M.

4. **An outline of the expectations of student academic appointees (SAA's) and of their faculty supervisors**

    - Supervision plan: The College has provided guidance for supervision of SAAs located in this portal.
    - Evaluation form: AIs with instructing capacities (beyond just grading) will be evaluated following this form.

[1] Some statements herein were originally crafted by Prof. Spencer Hall for the EEB PhD program.

- Grievance policy for SAAs: Biology has established grievance policies for SAAs. Please note that this grievance pathway is separate from issues of academic standing (and described by and managed by the College Graduate Office here).
- The Microbiology Handbook also clarifies the research activities as both an SAA and a scholar.
- Most Microbiology faculty have 'lab culture statements' that include expectations that PI's have of their students and that students should have of that PI. These statements are available to Microbiology students and faculty via a shared Onedrive folder.
- The College's best mentoring practices are included in the Microbiology Handbook Appendix M.

5. **Indication of how students can report their experience, for example through a climate survey**

- Students can consult Appendix B of the Microbiology Handbook to identify the appropriate people to report various experiences.
- The Microbiology Graduate Program Director maintains a Google Form where students can leave anonymous feedback. The form is always open but students are prompted to use the form ahead of townhall meetings.
- The Microbiology Graduate Program Director holds a townhall meeting with Microbiology students every Fall and holds additional meetings and surveys as needed.
- The Biology graduate advisor holds a yearly townhall meeting for biology PhD students.
- Anonymous feedback from students is collected after each graduate-recruiting weekend, both on GRW and student impressions on prospective students.
- The Biology graduate office conducts an exit survey when students graduate.

6. **Discussion of the role of the unit's graduate student association in student well-being**

- Contact information and a brief description of the Microbiology Graduate Student Association (MGSA) and other student associations within and outside of the department is in the Microbiology Handbook Appendix B.
- MGSA organizes several events each year, focused on professional development and strengthening social ties between students and between faculty and students.

7. **Information on conflict resolution and grievance procedures within the department and beyond**

- Students can consult Appendix B of the Microbiology Handbook to identify the appropriate people and offices to report various grievances.
- Grievance policy for SAAs: Biology has established grievance policies for SAAs. Please note that this grievance pathway is separate from issues of academic standing (and described by and managed by the College Graduate Office here).

- Microbiology program expectations of training faculty are described in Appendix P of the Microbiology Handbook.
- The Microbiology Handbook describes probation procedures that could result from unsatisfactory scholarly progress identified at committee meetings or low grades.
- Academic misconduct procedures are described in the Microbiology Handbook.
- A guide to switching labs is provided in Appendix Q of the Microbiology Handbook.

8. Attention to professionalization that stretches beyond any required course

- Programmatic requirements are described in Appendix A of the Microbiology Handbook. These include presentations within the department and at national conferences, the publication or submission of at least one first author paper, and service as an associate instructor for at least one semester.
- Students complete an individual development plan (IDP) every year and discuss it with their PI. Part of the IPD is focused on career plans. The IDP is available in Appendix E of the Microbiology Handbook.
- Microbiology has two seminar series, one featuring external speakers and the other featuring internal speakers, mostly graduate students. Students can have lunch with the external speakers to ask them about research, career paths, etc.
- MGSA organizes at least one panel per year focused on professional development. For example, panels sometimes feature alumni that have gone on to work in diverse areas.
- Students are referred to the Walter Career Center and several points in the Microbiology Handbook, including Appendix B.
- Students are made aware of the possibility of internships, with the policy described in Appendix J of the Microbiology Handbook.

9. Annual Evaluation - Academic

- The procedure for annual Advisory/Research committee meetings is described in the Microbiology Handbook, with an evaluation rubric in Appendix F. Students must document the completion of committee meetings by CCing the Grad Program Director and/or Asst Director of Grad Studies when the written summary is submitted to the committee. PI's must also submit the committee meeting rubric. The scheduling procedure and expectations for committee meetings are in Appendix G of the Microbiology Handbook.
- Students also evaluate their own strengths and weaknesses annually using an IDP available in the Microbiology Handbook Appendix E. Students talk through the IDP with their PI and, if deemed beneficial, at their annual committee meeting.

Appendix S. Microbiology program guidelines on the use of artificial intelligence in graduate scholarship

Modified from living guidelines created by EEB faculty (v. December, 9 2023)

Large language models (LLMs) and other generative AI tools (e.g.,ChatGPT, Copilot) are increasing in availability and quality. LLMs have the potential to streamline some elements of PhD scholarship but if used uncritically, they can hinder the development of skills and knowledge. *The goal of this document is to provide guidelines for grad student use of LLMs in their scholarship, particularly prelims and dissertation chapters.*

General considerations about Ph.D. scholarship

- The purpose of PhD scholarship and writing a dissertation is to (1) develop mastery in a core area, and (2) develop, implement, interpret, and write original research on a topic that addresses a critical gap in the literature. Dissertations are meant to address significant problems by promoting new ways of thinking and by unifying disparate concepts. This process provides opportunities to develop ideas, question assumptions in the literature, hone communication skills, and grow as thinkers. Reliance on LLMs without critically questioning the output will not meet the basic standards of PhD scholarship nor result in useful professional development.
- The purpose of the "knowledge component" of the prelim exam, is to evaluate whether students possess the foundation needed to develop original research. Successful completion requires a demonstration of: (a) mastery of major concepts and research strategies within and adjacent to one's research area; (b) competency and recall of relevant literature, and fluent use of foundational literature in written and oral answers; (c) answering questions logically; and (d) writing clearly.
- The purpose of the "research component" of the prelim exam, is to evaluate whether students can articulate specific and well-reasoned plans for their dissertation chapters. Successful completion requires a demonstration of : (a) identifying and proposing to address one or more critical gaps in the literature (b) proficiency of scholarship based on accumulation of motivating data; (c) firm grounding in conceptual theory; (d) display of items (tables, figures, etc.) with informative captions; (e) clear, organized writing.

LLMs and Ph.D. scholarship

- Any use of LLMs within the Microbiology curriculum, including in the preparation prelim exam materials and dissertations, must be acknowledged and the mode of use described.[1]
- LLMs can produce content that is *inaccurate, incomplete or biased.* LLMs can present untrue statements as facts, can include outdated information, and can reproduce biases that exist in the content on which they were trained. If a student uses LLMs to learn ideas, find papers, write code, etc. and the output is wrong, the student knowingly or unknowingly replicates that error. **Thus, the responsibility of ensuring that information gleaned from LLMs is correct falls solely with the student, as students are responsible for the content of their scholarship, no matter the sources used.**

- LLM use is a rapidly changing area of research policy. Students are responsible for adhering to requirements put forth by funding agencies, societies, and journals in which they intend to publish dissertation chapters. For example, some journals restrict LLM use to only those actions that "improve readability and language."
- IU's Code of Student Rights, Responsibilities, & Conduct prohibits plagiarism, which includes insufficient paraphrasing of work generated from someone other than the student (including LLMs), as well as using text derived from other people or programs without attribution.
- IU has its own guidelines for acceptable uses of LLMs. While many of these guidelines are not directly related to Ph.D. scholarship, students should adhere to them as well. Courses taken by graduate students might also have specific restrictions on LLM use, communicated within a syllabus and/or by the instructor that would take precedence within that course.
- LLMs, other than Microsoft CoPilot within the IU environment, cannot be used with IU institutional data without prior institutional review. kb.iu.edu/d/biit, uits.iu.edu/ai/index.html

Potentially useful applications of LLMs as part of PhD scholarship[1]

1. LLMs can be used to accelerate the process of searching for literature
2. LLMs can be used to help draft, debug or annotate your code (e.g., in R, Python)
3. LLMs can be used for 'light editing', similar to spelling or grammar checks that already exist in many word processing programs. It is the student's responsibility to ensure that LLMs do not change the intended meaning of the text.
4. LLMs can be used for back and forth exchanges to learn about unfamiliar terms and principles, similar to the way you might read a Wikipedia article before researching the primary literature. LLMs alone are a poor substitute for reading papers critically and carrying out one's own synthesis.
5. LLMs can be used to generate ideas and potential research questions. Students who use LLMs in this way are expected to be able to articulate their ideas/questions orally.

This list does not address all possible uses. We encourage students who want to use LLMs in other ways to seek out and document unambiguous approval, in advance, from their advisory/research committee chair (PI) and committee members.

[1]Students who use LLMs should document and acknowledge exactly how they have used AI via a 'Declaration of Generative AI Use' (or similar). Many journals are already requiring these statements, which are placed in the Acknowledgements, Methods, or Cover Letter. The statement should specify the tool used and how it was used. Some groups have called for making the input and output LLMs available with the publication"(see article in Nature).