



MMBIO

GRADUATE
HANDBOOK
2023 - 2024

BRIGHAM YOUNG UNIVERSITY

Department of Microbiology and Molecular Biology

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MMBIO GRADUATE PROGRAMS SUMMARY

The Microbiology and Molecular Biology Department (MMBio) offers two graduate degrees:

- Doctor of Philosophy (Ph.D.) in Microbiology and Molecular Biology
- Master of Science (MS) in Microbiology and Molecular Biology

The MS and Ph.D. programs emphasize a combination of research experience and interdisciplinary course work. Research emphases include gene regulation, host-microbe recognition processes, virus and phage biology, microbial physiology, immunology, cancer biology, and medical informatics. The Ph.D. degree additionally requires the ability to independently recognize opportune scientific problems and to craft multidimensional research proposals. Ph.D. students are responsible for the creation of a substantial body of research findings, and publication of these findings in prominent scientific journals. Completion of the MS or Ph.D. degree prepares graduates for further study at the Ph.D. or postdoctoral level; or for employment in academic, private-sector, or government-funded research, development, and teaching endeavors.

Ph.D. DEGREE REQUIREMENTS

LENGTH OF TIME TO COMPLETE DEGREE

Five to six years (average time); eight years (university limit)

CREDIT-HOURS

- Ph.D. after BS: 54 credit-hours total (At least 18 didactic credit-hours, 18-20 research credit-hours, and 18 dissertation credit-hours)
- Ph.D. after BYU MMBio MS: 36 credit-hours total (18-20 research, 18-dissertation)

COURSE REQUIREMENTS

- CELL 570, Responsible Conduct of Research, 1 credit, offered winter only
- MMBIO 660, Microbiology and Immunology, 3 credits, offered fall only
- MMBIO 661, Molecular Genetics in Practice, 2 credits, offered fall only
- MMBIO 663, Articulating Science, 2 credits, offered winter only
- MMBIO 665, Genomics, 3 credits, offered winter only
- MMBIO 691R, Graduate Seminar, 2 credits (1 per semester), offered fall and winter (Attend every fall & winter semester, but only register for it two times for two total credit hours)
- MMBIO 692R, Research in Progress, 2 credits (1 per semester), offered fall and winter (Attend every fall & winter semester, but only register for it two times for two total credit hours)
- MMBIO 695R, Research (18-20 credits)
- MMBIO 799R, Doctoral Dissertation (18 credits)
- Graduate elective courses, 3-6 credits, as approved by committee

RESEARCH REQUIREMENT

To obtain the Ph.D. degree, the student must generate a substantial body of research findings. The determination of sufficient productivity is left to the advisory committee, as it adheres to the following general guidelines:

- The student is expected to publish multiple first-author research papers in reputable peer-reviewed journals prior to the dissertation defense.
- In no case can a student defend his or her dissertation without at least two first-author research papers that are either published or in press by the dissertation defense date.

ROTATIONS

Rotations allow students to spend a period of time in two or more faculty labs during the first few months of the program, giving them broader exposure to faculty research interests as well as getting to know faculty members prior to joining a lab. Lab rotations can be made with any eligible faculty of choice, if space is available. Students should take the initiative in asking faculty members for rotation experiences. Students can receive credit for MMBIO-695R for this research experience.

Ph.D. students who are financially supported by the department are strongly encouraged to do rotations during the first semester of their program (two to three rotations are typical). These rotations should last approximately three weeks each and the first rotation should begin at the end of the first week. These rotations should be with those faculty members who have open

Ph.D. slots. After rotations are completed, a mutual decision between student and faculty is reached regarding the choice of research advisor.

FORMATION OF ADVISORY COMMITTEE

The advisory committee advises, directs, and approves the graduate student's program, both the academic work and the research work. Each committee member is involved in training and mentorship of assigned students. Careful evaluation, rigorous review of student research and instruction, and regularly scheduled meetings can ensure a quality experience. Students should feel free to meet with committee members individually or as a group as frequently as help and advice are needed. The student takes the initiative in the formation of the committee in conjunction with their research advisor, and in scheduling the required semi-annual progress review meetings, which take place during the first half of November and during the first half of May. Additional progress review meetings may be requested by the committee.

The student is initially assigned to be advised by the MMBio Graduate Committee Chair, until the permanent advisory committee is established. If students have not chosen their research advisor by the November progress review meeting, the student should hold this first November meeting with the MMBio Graduate Committee Chair and two additional temporary committee members. The student must choose a permanent graduate advisory committee by January 31. If a permanent graduate advisory committee is not formed by the second progress review meeting, the student will be terminated from the program. Members comprising the advisory committee are selected by the student in consultation with the student's research advisor. The advisory committee is formally organized as approvals are given on the webpage <https://GRADPROGress.sim.byu.edu/> (GRADPROG), under the Committee section.

The Ph.D. advisory committee is comprised of at least four faculty members. The committee chair is the student's research advisor. Students are encouraged to invite one faculty member from a non-MMBio department to participate on this advisory committee, though this is no longer a requirement. At least three faculty members from MMBio are required to be on the committee. Faculty with a conflict of interest (including related individuals) are welcome and encouraged to advise students but may not serve on the committee.

All members of the committee should be present at semi-annual progress review meetings, including the prospectus approval meeting held in November of the second year. If one member cannot attend, then the student can talk with that member individually to give updates and get signatures if the research advisor approves. However, for the qualifying exam and dissertation defense meeting, all members must be present. For the qualifying exam, committee members may attend remotely, via Zoom or some similar videoconferencing technology only if they are out of town and away from the local area or they are having health issues. A petition for exception will be required in these instances and the Academic Program Coordinator should be notified to begin the exception petition. For the dissertation defense, all committee members must meet in person.

PROGRAM OF STUDY

The Program of Study is a list of courses that meet both the program's requirements and the student's personal area of focus and interest. This list is determined by the student in consultation

with the advisory committee. Most courses should be completed within the student's first year in the program.

The Program of Study is submitted by the student and approved by the committee on the webpage <https://GRADPROGress.sim.byu.edu/> (GRADPROG), under the Program of Study section. It is preferable to have this completed during the first progress review meeting but is formally due immediately after the second progress review (May of first year). If it becomes necessary to alter the course plan or the composition of the advisory committee, the student or Academic Program Coordinator can make changes and then each member of the committee must approve it on the GRADPROG website.

Students desiring to take classes not on their Program of Study list need to get their research advisor's approval before registering. The student may be required to pay for the cost of tuition for such courses.

REQUIRED SEMI-ANNUAL PROGRESS REVIEW MEETINGS

In November and May of each year (between the 1st and 15th of each month), graduate students meet with their advisory committee in a formal progress review meeting. Ideally, this meeting will last approximately 30-60 minutes. Other settings would be more appropriate for highly detailed discussions on research strategies. The student is responsible for scheduling the time and location of the meeting and completing appropriate online Adobe Sign forms including the standard progress review form (Form A). These forms are available upon request of the Academic Program Coordinator. Please suggest only a few days of schedule options for committee members instead of several weeks' worth of time. The student's research advisor conducts the meeting.

The progress review meeting agenda is as follows:

- Ten-minute PowerPoint presentation by the student, with minimal interruption from committee members (formatting for this presentation is detailed below).
- Ten-minute discussion with committee.
- Three-minute deliberation by committee, with the student outside the room.
- Five-minute follow-up discussion with the student, where the verdict (satisfactory / marginal / unsatisfactory) is announced, and the student is given further advisement about how to proceed in coming months.

Format for the ten-minute student presentation:

- **Context:** One to two slides to provide context and background information relevant to the research project including a recap of scientific aims.
- **Central Questions:** One slide entitled "Central Questions" setting forth the central question(s) addressed in the research project. After each question, list approaches being used to address the question. This should all fit on a single slide.
- **Key Indicators:** Two slides entitled "Key indicators" detailing start date in the program, anticipated graduation date, courses completed, current and future courses, current GPA, and the following data for the past six months: hours per week of research-related activities, percent attendance in RIP, percent attendance in seminars, TA responsibilities, publications / presentations, and course grades. Slide two should include a screenshot of page two from the

last Form A and what was accomplished per the suggestion of your committee. If this is your first Progress Review Meeting, then only one slide is required.

- **Results and troubleshooting:** Five to eight slides showcasing progress toward addressing the central question(s), including barriers to progress and alternative approaches.
- **Plans:** One slide outlining research plans for the next six months.

Progress review meetings may serve multiple functions during the first two years:

- **The Program of Study** (see above) must be approved in progress review two (May of first year).
- **The Prospectus** (see below) must be presented and approved in progress review three (November of second year).
- **The Qualifying Exam** (see below) must be conducted during progress review four (May of second year). Note, the senior member of the student's advisory committee, who is the longest tenured faculty member in the MMBio department and is not the research advisor, will conduct the exam. A member of the Graduate Committee must be present at the qualifying exam, and it is the responsibility of the student to ensure that a Graduate Committee member has been invited and can attend.

In every progress review, a student's progress is rated "Satisfactory," "Marginal," or "Unsatisfactory" by the committee. A satisfactory rating recommends continuation in the program. Marginal or unsatisfactory ratings require the committee to list the changes and requirements a student needs to meet within a specified period of time to remedy the problem(s) and become eligible for satisfactory at the next review meeting. Two consecutive marginal / unsatisfactory ratings result in termination of a student's program. When no evaluation is submitted, the university considers this "unsatisfactory." Committee members should refer back to the previous Form A, page two, to determine whether a student has completed what was expected of them until the next progress review meeting. Additional progress review meetings may be scheduled, if a marginal or unsatisfactory rating is given, between the formal May and November meetings. These additional meetings will follow the same format as the May and November progress review meetings and a satisfactory, marginal, or unsatisfactory rating will be given.

Examples of Marginal or Unsatisfactory Progress:

- Failure to submit or complete Program of Study
- Limited or lacking progress toward courses and requirements on Program of Study
- Failure to establish a graduate committee by handbook deadline
- If admitted provisionally, not completing the provisions
- Minimal contact with research advisor or advisory committee members
- Failure to submit an approved thesis / dissertation prospectus by handbook deadline
- Prospectus or thesis / dissertation draft not approved
- Grade below B- in any class
- Less than 75% attendance at RIP meetings and seminars
- Not attending the annual graduate retreat
- Not completing requirements from a previous unsatisfactory / marginal evaluation
- Not spending sufficient time in the laboratory to accomplish research

- Not progressing in the program, such as no results in experiments or no papers written
- Not being able to state any accomplishments since the last progress review
- Failed to pass Qualifying / Coursework Exam or Oral Defense
- Registering for thesis / dissertation hours when little or no work has been done
- Concerns about ethical or professional behavior
- Violating graduate student policies

INDIVIDUAL DEVELOPMENT PLAN (IDP)

National agencies that fund scientific research require Individual Development Plans for graduate students. IDPs provide a structured opportunity to plan career development activities as part of graduate training. They are meant to facilitate a self-evaluation of skills and goals that should lead to a career plan and implementation of that plan. The IDP is an iterative process and ideally, should include collaboration between the student and their mentors or advisors. It can be used to positively affect the relationship with committee members or mentors so that there is a plan everyone can support that will lead to a better training experience.

Individual Development Plan – New Graduate Students

New students should submit their IDP in consultation with their research advisor between September 1 and November 30 of their first year. If they do not yet have a research advisor, they should consult with the Graduate Committee Chair. Students should request form IDP-Initial from the Academic Program Coordinator and will use this form to submit their preliminary career goals and discuss how their MMBio graduate studies will help them achieve their objectives.

Individual Development Plan – Continuing Graduate Students

Continuing students (MS or Ph.D.) should submit their yearly IDP in consultation with their research advisor between September 1 and November 30 of the current year. Students should refer to their last years' IDP as they revise and update their career plans and reflect on their progress towards achieving their goals. They should request form IDP-Continuing from the Academic Program Coordinator.

PROSPECTUS

The Prospectus should be created in conjunction with the research advisor. Plans for the prospectus should be formulated by the student in consultation with, and then approved by, the advisory committee. The research advisor must give preliminary approval before the prospectus is sent to the entire committee. The prospectus should be prepared in sufficient time to go through multiple rounds of review with their research advisor. The prospectus is the student's research proposal, and ideally, it becomes the outline of the student's dissertation.

A general format for the written prospectus would include:

- Background information, significance, and project justification
- Clear statement of key questions and hypotheses being tested
- Experimental plan, including alternatives if planned approaches fail
- Expected results and timeline

- Bibliography

Generally, a dissertation prospectus will be 10 to 15 pages in length (single spaced with figures and tables, excluding the bibliography).

The prospectus approval meeting should be conducted as follows:

- The student is responsible for scheduling the time and place of the meeting, as for all progress review meetings.
- The student provides the written prospectus (electronically) to all committee members at least seven days before the approval meeting.
- Committee members are expected to be familiar with the details of the prospectus prior to the meeting.
- The student will orally present with minimal interruption by committee members, using the following format: one to two slides providing context and background information relevant to the research project including a recap of scientific aims; two slides summarizing key indicators (see instructions for semi-annual progress review meetings, above); one slide summarizing research progress in the last six months; five slides to summarize the prospectus, bearing in mind that the committee has read the prospectus in its entirety. This presentation should last between five and ten minutes.
- Committee members will lead a discussion focusing on strengths and weaknesses of the proposal.
- The student will be excused for deliberation.
- The student will be invited back to receive feedback from the committee relating to the progress review outcome (satisfactory / marginal / unsatisfactory) and approval of the prospectus. In many cases, the prospectus will be approved with qualifications, which may include significant revisions to the written document. Committee members will detail what these revisions are to accomplish, and how the qualifications will be approved, and the deadline they will be met.

Prospectus approval is formalized by a digitally signed copy of the Adobe Sign Prospectus form, which can be obtained upon request from the Academic Program Coordinator. This form must be filled out and digitally signed by the student before the progress review meeting along with Form A. **Students must also upload a final digital copy of the prospectus to the Prospectus section in GRADPROG <https://GRADPROGress.sim.byu.edu/>.** The deadline for the prospectus is progress review three (November of the 2nd year) for Ph.D. students.

QUALIFYING EXAM

The qualifying exam advances a Ph.D. student to candidacy. It should be taken no later than the student's fourth progress report (May of their 2nd year). Failure to complete this exam within the timeframe may result in an unsatisfactory progress review. This is an important make-or-break event on the path to a Ph.D. The qualifying exam requires students to identify interesting phenomena in diverse areas of biology, to propose models to explain these phenomena, and to design sound experiments to test these models. The exam also requires students to demonstrate familiarity with core theoretical and experimental principles learned in their coursework and elsewhere. A current member of the graduate committee must be present for the qualifying exam.

The Qualifying Exam consists of two parts:

1. Comprehensive Exam

- a. The comprehensive exam is an oral exam. This exam is conducted by a standing committee made up of MMBio graduate faculty, to ensure equity in all exams taken each year. If the student's research advisor is on the standing committee, then a substitution will be made. A current member of the graduate committee must be present for this exam. The student is responsible for arranging the time and place of the oral exam. The student will complete the digital Form A, as well as the digital Form "Qualifying Exam," before the exam meeting. The student's research advisor should attend the exam but should not ask or answer questions during the exam.
- b. This exam has several purposes: to test a student's knowledge of core topics in microbiology and molecular biology; to examine critical thinking skills; to assess the student's ability to design experiments to address key questions typically studied in the fields of microbiology and molecular biology; to critically interpret example data and to assess if appropriate controls are included; and to explain how statistical analysis is performed.
- c. Judging the Qualifying Exam
 - i. Who:
 1. A standing committee made up of MMBio graduate faculty judges the exam.
 2. The senior member of the MMBio graduate faculty, who is not the student's research advisor, will conduct the exam.
 - ii. Results: The committee may vote to "pass," "pass with qualifications," "recess," or "fail".
 1. It is possible to stop the exam at any point if two or more examiners vote to recess. This permits the candidate to reschedule the exam a second time. If the student does not pass the exam the second attempt, the student will be terminated from the program.
 2. If two or more examiners vote to fail, the examination is failed, and the graduate degree program of the student is terminated.
 3. If the committee decides to "pass with qualifications," then the qualification must be met by the student before they may submit the paperwork. Failure to meet qualifications within one month will be grounds to terminate the student from the program.

2. On-Topic Grant Proposal and Defense

- a. The purpose of this exam is:
 - i. to assess a student's ability to come up with unanswered questions that merit research
 - ii. to develop relevant hypotheses, to design experiments with appropriate controls
 - iii. to be able to articulate predicted results that support or refute a hypothesis
 - iv. and to explain an appropriate approach for statistical analysis
- b. The student will write an NIH R15-style proposal that is on a topic related to the student's chosen area of research. The proposal should be 12 pages, single spaced, not including references. Figures and tables may be appropriate to clearly explain preliminary data, experimental design, and/or anticipated results. The proposal

should be based on ideas generated by the student and the experimental design should also be developed by the student.

- i. To alleviate some of the stress associated with the Ph.D. qualifying exam, students are strongly encouraged to keep a record of potentially interesting proposal topics as they are encountered throughout their first two years in the program.
- c. Here is a link that gives direction on how to write an effective NIH proposal:
 - i. <https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm>
- d. This exam will take place one week after the comprehensive exam. The proposal should be emailed to the advisory committee and graduate committee member who will be attending at least a week before the scheduled exam.
- e. The senior member of the student's advisory committee, who is the longest tenured faculty member in the MMBio department and is not the research advisor, will conduct the exam. All members of the student's advisory committee must be present. The student's research advisor should attend the exam but should not ask or answer questions during the exam. The research advisor will be consulted to determine how novel the questions / hypotheses / approaches truly are.
- f. The committee may vote to "pass," "pass with qualification," "recess," or "fail". It is possible to stop the exam at any point if two or more examiners vote to recess. This permits the candidate to reschedule the exam a second time. If the student does not pass the exam the second attempt, the student will be terminated from the program.
- g. If two or more examiners vote to fail, the examination is failed, and the graduate degree program of the student is terminated. If the committee decides to "pass with qualifications," then the qualifications must be met by the student before they may submit the paperwork. Failure to meet qualifications within one month will be grounds to terminate the student from the program.
- h. Reporting the Exam: The Qualifying Exam form, is digitally signed and submitted to the Academic Program Coordinator. A copy of the grant proposal, in its final form, will also be submitted.

APPLICATION FOR GRADUATION

The student's advisory committee decides when a student has accomplished the requirements for graduation. Official approval from the committee is required and should be obtained by the student prior to applying for graduation. The research advisor should notify the Academic Program Coordinator that the student is approved to apply for graduation.

Graduation times are at the end of each semester or term: April, June, August, and December.

- **When to apply:** Usually before the beginning of the final semester of a student's program. Check the university deadlines.
- **How:** Apply online through GRADPROG <https://GRADPROGress.sim.byu.edu/>.
 - Make sure you have a current ecclesiastical endorsement for the semester you graduate and be enrolled in a minimum of 2.0 credits during the semester and 6.0 credits the year you wish to graduate.

- Review the “Graduate Progress Report: Microbiology and Molecular Biology PH.D.” in GRADPROG (<https://GRADPROGress.sim.byu.edu/>) and make sure it is correct.
- Type in your name the way you would like it to appear on your diploma.
- Inform the Academic Program Coordinator that you have applied for graduation.

WRITING THE DISSERTATION

Students can begin writing their dissertation as soon as their project has matured sufficiently, and they have the approval of their committee. Writing and continually revising along the way helps to clarify thinking and creates a better dissertation document. The student should not wait for all experiments or analysis to be complete before they begin writing their dissertation.

Check the university requirements on the GRADPROG webpage under the resources tab <https://GRADPROGress.sim.byu.edu/resources>. Information includes requirements for format, style, preparing work for departmental approval, and preparing and submitting copies, forms, and fees to the library.

The final version of the dissertation should include the following:

1. Title page
2. Abstract page
3. Table of Contents
4. List of Tables
5. List of Figures
6. Thorough introduction, including background information from the published literature
7. Research chapters*
8. Summary / discussion of findings
9. Complete bibliography
10. Appendices. Unpublished data may also be included.

*Ideally, a student’s published work, including work in preparation for publication, will constitute the research chapters. These manuscripts will typically be inserted as double-spaced text, with figures and tables appropriately embedded.

FINAL RESEARCH REVIEW MEETING

The final review of the student’s research is held with the advisory committee (in conjunction with the final semi-annual progress review) to assure both the student and the committee that the body of research is satisfactorily completed, and the writing of the dissertation is underway. The student should present a final draft of the dissertation to their committee members soon after this meeting. The committee decides if the student is ready to defend and graduate.

This meeting is held prior to scheduling the dissertation defense. The recommended time to schedule this review meeting is at the final progress review, which would be in May for students graduating in June or August, or in November for students graduating in December or April.

As with all advisory committee meetings, it is the responsibility of the student to initiate and schedule this meeting.

PRIOR TO DEFENSE

Prior to scheduling the defense, a final copy of the approved dissertation must be uploaded in GradProg (<https://GRADPROGress.sim.byu.edu/resources>) under “Ready for Defense.” This should be done two weeks prior to the proposed date of the dissertation defense. Once the committee has certified that the student is ready to defend, then the defense may be conducted. It is important to share the date / time of the dissertation defense with the Academic Program Coordinator as soon as it is known. The student is responsible to schedule the date, time, and place at least two weeks in advance of the defense. It is mandatory to meet with the Academic Program Coordinator to go over the details of the defense.

DISSERTATION DEFENSE

The dissertation defense is conducted when the student has written their dissertation and is prepared to defend it. Normally this is during the last semester the student is on campus.

The Dissertation Defense consists of two parts:

1. The presentation of the dissertation
 - a. The BYU academic community is invited to listen and ask questions at the presentation.
2. The oral defense
 - a. Held immediately after the oral presentation, in a closed session.
 - b. The defense committee asks questions and votes on the student’s performance.

Judging the Defense

1. Who:
 - a. The exam committee judges the exam. It is made up of the student’s advisory committee.
 2. The senior member of the student’s advisory committee, who is the longest tenured faculty member in the MMBio department, and is not the research advisor, will conduct the exam.
3. Results: The committee may vote to “pass,” “pass with qualifications,” “recess,” or “fail” the student.
 - a. If the decision is to “pass with qualifications,” the advisory committee may require minor revisions of the dissertation or strengthening of the candidate’s preparation in subject matter areas. When these qualifications are cleared, and the committee has properly approved the passing of the defense in GradProg, the student is judged to have passed the examination.
 - b. If two or more examiners vote to recess, the examination is stopped and postponed. This permits the candidate to reschedule (with the department and the Office of Graduate Studies) a second and final examination. The new examination cannot be held sooner than one month after the recessed examination. In addition, the second examination must be convened with the original committee. If the student does not pass an exam for a second time, the student will be terminated from the program.
 - c. If two or more examiners vote to fail, the examination is failed, and the graduate degree program of the student is terminated.

The advisory committee will communicate the results of the defense to the Graduate Committee Chair and Academic Program Coordinator. Depending on the results, the advisory committee will assist with any revisions that may be necessary.

AFTER DEFENDING

- Once the defense has been passed, make an electronic copy of your dissertation for the library. This is referred to as an ETD. You can find out how to do this at <http://etd.byu.edu>. Please allow yourself several days to complete this requirement.
- Work with the BYU Library and the Academic Program Coordinator on the formatting of the ETD to ensure it is ready to be submitted. Do not submit the ETD until the Academic Program Coordinator gives you approval to do so.
- The ETD is submitted online through GRADPROG and then it must be approved by the department, the Dean's office, and Graduate Studies.
- It is the student's responsibility to monitor the deadlines and to know the requirements of the ETD process. Deadlines can be found on the GRADPROG webpage under the Resources tab <https://GRADPROGress.sim.byu.edu/resources>.
- Check your progress report for any "T" grades given for dissertation or research courses. A diploma will not be granted unless these have been changed to passing grades.

MS DEGREE REQUIREMENTS

LENGTH OF TIME TO COMPLETE DEGREE

MS Degree: Two years (anticipated time); five years (university limit)

CREDIT-HOURS

30 total credit-hours (5-8 research credit-hours and 6 thesis credit-hours)

COURSE REQUIREMENTS

- CELL 570, Responsible Conduct of Research, 1 credit, offered winter only
- MMBIO 660, Microbiology and Immunology, 3 credits, offered fall only
- MMBIO 661, Molecular Genetics in Practice, 2 credits, offered fall only
- MMBIO 663, Articulating Science, 2 credits, offered winter only
- MMBIO 665, Genomics, 3 credits, offered winter only
- MMBIO 691R, Graduate Seminar, 2 credits (1 per semester), offered fall and winter (Attend every fall & winter semester, but only register for it two times for two total credit hours)
- MMBIO 692R, Research in Progress, 2 credits (1 per semester), offered fall and winter (Attend every fall & winter semester, but only register for it two times for two total credit hours)
- MMBIO 695R, Research (5-8 credits)
- MMBIO 699R, Master's Thesis (6 credits)
- Graduate Elective courses, 3-6 credits, as approved by committee

RESEARCH REQUIREMENT

A thesis-based masters includes rigorous research. Good research consists of well-planned, repeatable experiments with appropriate controls. Students are expected to understand the significance of their research and the novel insights it brings to the field.

ROTATIONS

Rotations allow students to spend a period of time in two or more faculty labs during the first few months of the program, giving them broader exposure to faculty research interests as well as getting to know faculty members prior to joining a lab. Lab rotations can be made with any eligible faculty of choice, if space is available. Students should take the initiative in asking faculty members for rotation experiences. Students can receive credit for MMBIO-695R for this research experience. MS students not already committed to a lab are given the option to do rotations during the first semester of their program (two to three rotations are typical). These rotations should last approximately three weeks each and the first rotation should begin at the end of the first week. After rotations are completed, a mutual decision between student and faculty is reached regarding the choice of research advisor.

FORMATION OF ADVISORY COMMITTEE

The advisory committee advises, directs, and approves the graduate student's program, both the academic work and the research work. Each committee member is involved in training and mentorship of assigned students. Careful evaluation, rigorous review of student research and instruction, and regularly scheduled meetings can ensure a quality experience. Students should feel free to meet with committee members individually or as a group as frequently as help and advice are needed. The

student takes the initiative in the formation of the committee, and in scheduling the required semi-annual progress review meetings, which take place during the first half of November and during the first half of May. Additional progress review meetings may be requested by the committee.

The student is initially assigned to be advised by the MMBio Graduate Committee Chair, until the permanent advisory committee is established. The student must choose a permanent graduate advisory committee by the 1st progress review meeting (November of the first year). If a permanent graduate advisory committee is not formed by the 1st progress review meeting, the student will be terminated from the program. Members comprising the advisory committee are selected by the student in consultation with the student's research advisor (committee chair). The advisory committee is formally organized as approvals are recorded on the GRADPROG <https://GRADPROGress.sim.byu.edu/> webpage under the committee tab.

The MS advisory committee is comprised of at least three faculty members. The committee chair is the student's research advisor. Students may consider inviting one faculty member from a non-MMBio department to participate on this advisory committee. Faculty with a conflict of interest (including related individuals) are welcome and encouraged to advise students but may not serve on the committee.

All members of the committee should be present at semi-annual progress review meetings, including the prospectus approval meeting held in May of the 1st year. If one member cannot attend, then the student can talk with that member individually to give updates and get signatures if the research advisor approves. However, for the coursework exam and thesis defense meeting, all members must be present. For these two key exams, committee members may attend remotely, via Zoom or some similar videoconferencing technology only if they are out of town and away from the local area or they are having health issues. A petition for exception will be required in these instances and the Academic Program Coordinator should be notified to begin the exception petition. For the thesis defense, all committee members must meet in person.

PROGRAM OF STUDY

The Program of Study is a list of courses that meet both the program's requirements and the student's personal area of focus and interest. This list is determined by the student in consultation with the advisory committee. Most courses should be completed within the student's first year in the program.

The Program of Study is submitted by the student and approved by the committee on the webpage <https://GRADPROGress.sim.byu.edu/> (GRADPROG), under the Program of Study section. It is preferable to have this completed during the first progress review meeting but is formally due immediately after the second progress review (May of first year). If it becomes necessary to alter the course plan or the composition of the advisory committee, the student or Academic Program Coordinator can make changes and then each member of the committee must approve it on the GRADPROG website.

Students desiring to take classes not on their Program of Study list need to get their research advisor's approval before registering.

REQUIRED SEMI-ANNUAL PROGRESS REVIEW MEETINGS

In November and May of each year (between the 1st and 15th of each month), graduate students meet with their advisory committee in a formal progress review meeting. Ideally, this meeting will last approximately 30-60 minutes. Other settings would be more appropriate for highly detailed discussions on research strategies. The student is responsible for scheduling the time and location of the meeting and completing the appropriate online Adobe Sign forms including the standard progress review form. These forms are available upon request of the Academic Program Coordinator. Please suggest only a few days of schedule options for committee members instead of several weeks' worth of time. The student's research advisor conducts the meeting.

The progress review meeting agenda is as follows:

- Ten-minute PowerPoint presentation by the student, with minimal interruption from committee members (formatting for this presentation is detailed below).
- Ten-minute discussion with committee.
- Three-minute deliberation by committee, with the student outside the room.
- Five-minute follow-up discussion with the student, where the verdict (satisfactory / marginal / unsatisfactory) is announced, and the student is given further advisement about how to proceed in coming months.
- The student ensures forms are signed by committee members, approved by the Graduate Committee Chair, and returned to the Academic Program Coordinator.

Format for the ten-minute student presentation:

- **Context:** One to two slides to provide context and background information relevant to the research project including a recap of scientific aims.
- **Central Questions:** One slide entitled "Central Questions" setting forth the central question(s) addressed in the research project. After each question, list approaches being used to address the question. This should all fit on a single slide.
- **Key Indicators:** Two slides entitled "Key indicators" detailing start date in the program, anticipated graduation date, courses completed, current and future courses, current GPA, and the following data for the past six months: hours per week of research-related activities, percent attendance in RIP, percent attendance in seminars, TA responsibilities, publications / presentations, and course grades. Slide two should include a screenshot of page two from the last Form A and what was accomplished per the suggestion of your committee. If this is your first Progress Review Meeting, then only 1 slide is required.
- **Results and troubleshooting:** Five to eight slides showcasing progress toward addressing the central question(s), including barriers to progress and alternative approaches.
- **Plans:** One slide outlining research plans for the next six months.

Progress review meetings may serve multiple functions during the first two years:

The Program of Study (see above) must be approved no later than progress review two (May of first year).

The Prospectus (see below) must be presented and approved in progress review three (November of second year).

The Coursework Exam (see below) must be conducted during progress review four (May of second year). Note, this meeting is conducted by the senior member of the student's advisory

committee, who is the longest tenured faculty member in the MMBio department and is not the research advisor. A member of the Graduate Committee must be present at the coursework exam, and it is the responsibility of the student to ensure that a Graduate Committee member has been invited and can attend.

In every progress review, a student's progress is rated "Satisfactory," "Marginal," or "Unsatisfactory" by the committee. A satisfactory rating recommends continuation in the program. Marginal or unsatisfactory ratings require the committee to list the changes and requirements a student needs to meet within a specified period of time, to remedy the problem(s) and become eligible for satisfactory at the next review meeting. Two consecutive marginal / unsatisfactory ratings result in termination of a student's program. When no evaluation is submitted, the university considers this "unsatisfactory." Committee members should refer back to the previous Form A, page two, to determine whether a student has completed what was expected of them until the next progress review meeting. Additional progress review meetings may be scheduled, if a marginal or unsatisfactory rating is given, between the formal May and November meetings. These additional meetings will follow the same format as the May and November progress review meetings and a satisfactory, marginal, or unsatisfactory rating will be given.

Examples of Marginal or Unsatisfactory Progress:

- Failure to submit or complete Program of Study
- Limited or lacking progress toward courses and requirements on Program of Study
- Failure to establish a graduate committee by handbook deadline
- If admitted provisionally, not completing the provisions
- Minimal contact with research advisor or advisory committee members
- Failure to submit an approved thesis / dissertation prospectus by handbook deadline
- Prospectus or thesis / dissertation draft not approved
- Grade below B- in any class
- Less than 75% attendance at RIP meetings and seminars
- Not attending the annual graduate retreat
- Not completing requirements from a previous unsatisfactory / marginal evaluation
- Not spending sufficient time in the laboratory to accomplish research
- Not progressing in the program, such as no results in experiments or no papers written
- Not being able to state any accomplishments since the last progress review
- Failed to pass Qualifying / Coursework Exam or Oral Defense
- Registering for thesis / dissertation hours when little or no work has been done
- Concerns about ethical or professional behavior
- Violating graduate student policies

INDIVIDUAL DEVELOPMENT PLAN (IDP)

National agencies that fund scientific research require Individual Development Plans for graduate students. IDPs provide a structured opportunity to plan career development activities as part of graduate training. They are meant to facilitate a self-evaluation of skills and goals that should lead to a career plan and implementation of that plan. The IDP is an iterative process and ideally, should include collaboration between the student and their mentors or

advisors. It can be used to positively affect the relationship with committee members or mentors so that there is a plan everyone can support that will lead to a better training experience.

Individual Development Plan – New Graduate Students

New students should submit their IDP in consultation with their advisor between September 1 and November 30 of their first year. If they do not yet have a research advisor, they should consult with the Graduate Committee Chair. Students should request form IDP-Initial from the Academic Program Coordinator and will use this form to submit their preliminary career goals and discuss how their MMBio graduate studies will help them achieve their objectives.

Individual Development Plan – Continuing Graduate Students

Continuing students (MS or Ph.D.) should submit their yearly IDPs in consultation with their research advisor between September 1 and November 30 of the current year. Students should refer to their last years' IDP as they revise and update their career plans and reflect on their progress towards achieving their goals. They should request form IDP-Continuing from the Academic Program Coordinator.

PROSPECTUS

The Prospectus should be created in conjunction with the research advisor. Plans for the prospectus should be formulated by the student in consultation with, and then approved by, the advisory committee. The research advisor must give preliminary approval before the prospectus is sent to the entire committee. The prospectus should be prepared in sufficient time to go through multiple rounds of review with their research advisor. The prospectus is the student's research proposal, and ideally, it becomes the outline of the student's thesis.

A general format for the written prospectus would include:

- Background information, significance, and project justification
- Clear statement of key questions and hypotheses being tested
- Experimental plan, including alternatives if planned approaches fail
- Expected results and timeline
- Bibliography

Generally, a MS prospectus will be eight to ten pages in length (single spaced with figures and tables, excluding the bibliography).

The prospectus approval meeting should be conducted as follows:

- The student is responsible for scheduling the time and place of the meeting, as for all progress review meetings.
- The student provides the written prospectus (electronically) to all committee members at least seven days before the approval meeting.
- Committee members are expected to be familiar with the details of the prospectus prior to the meeting.
- The student will orally present with minimal interruption by committee members, using the following format: One to two slides providing context and background information

relevant to the research project including a recap of scientific aims; two slides summarizing key indicators (see instructions for semi-annual progress review meetings, above); one slide summarizing research progress in the last six months; five slides to summarize the prospectus, bearing in mind that the committee has read the prospectus in its entirety. This presentation should last between five and ten minutes.

- Committee members will lead a discussion focusing on strengths and weaknesses of the proposal.
- The student will be excused for deliberation.
- The student will be invited back to receive feedback from the committee relating to the progress review outcome (satisfactory / marginal / unsatisfactory) and approval of the prospectus. In many cases, the prospectus will be approved with qualifications, which may include significant revisions to the written document. Committee members will detail what these revisions are to accomplish, and how the qualifications will be approved, and the deadline they will be met.

Prospectus approval is formalized by a digitally signed copy of the Adobe Sign Prospectus form, which can be obtained upon request from the Academic Program Coordinator. This form must be filled out and digitally signed by the student before the progress review meeting along with Form A. **Students must also upload a final digital copy of the prospectus to the Prospectus section in GRADPROG <https://GRADPROGress.sim.byu.edu/>.**

The deadline for the prospectus is progress review two (May of the 1st year) for MS students.

COURSEWORK EXAM

The oral coursework exam (for MS students) tests the knowledge gained from the core classes and electives the student has taken. It should be taken when coursework is completed (or nearly completed), and no later than the second year of the program. It cannot be taken on the same day that the thesis defense is held. In preparation for the coursework exam, the student should provide committee members with a list of all courses completed (and accompanying syllabi) or in progress. Prior to the exam, the student may consult with committee members about the kinds of questions they may anticipate, though committee members are expected to improvise questions during the exam. Students should expect that exam questions will mainly focus on fundamental biological processes in microbiology and molecular biology, and the expectation is that students will demonstrate mastery of these subjects, analytical thinking, and experimental design.

The student is responsible for scheduling the time and location for the exam. The student will start the digital Form A, as well as the digital form Coursework Exam prior to the start of the exam meeting. This meeting is conducted by the senior member of the student's advisory committee, who is the longest tenured faculty member in the MMBio department and is not the research advisor. The student will present one slide with key indicators (see instructions for semi-annual progress review meetings, above); one slide summarizing research progress in the last six months, and then the committee will conduct the exam. The student and committee should allocate a two-hour block for this meeting.

The committee may vote to “pass,” “pass with qualifications,” “recess,” or “fail” the student. If the decision is to “pass with qualifications,” the committee may require additional work. When

these qualifications are cleared, the student is judged to have passed the examination. It is possible to “stop” the exam at any point if two or more examiners vote to recess. This permits the candidate to reschedule the exam a second time. If the student does not pass the exam the second attempt, the student will be terminated from the program. If two or more examiners vote to fail, the examination is failed, and the graduate degree program of the student is terminated. After the exam, committee members will approve or disapprove in GRADPROG.

APPLICATION FOR GRADUATION

The student’s advisory committee decides when a student has accomplished the requirements for graduation. Official approval from the committee is required and should be obtained by the student prior to applying for graduation. The research advisor should notify the Academic Program Coordinator that the student is approved to apply for graduation.

Graduation times are at the end of each semester or term: April, June, August, and December.

- **When to apply:** Usually before the beginning of the final semester of a student’s program. Check the university deadlines.
- **How:** Apply online through GRADPROG <https://GRADPROGress.sim.byu.edu/>.
 - Make sure you have a current ecclesiastical endorsement for the semester you graduate and be enrolled in a minimum of 2.0 credits during the semester and 6.0 credits the year you wish to graduate.
 - Review the “Graduate Progress Report: Microbiology and Molecular Biology MS” in GRADPROG (<https://GRADPROGress.sim.byu.edu/>) and make sure it is correct.
 - Type in your name the way you would like it to appear on your diploma.
 - Inform the Academic Program Coordinator that you have applied for graduation.

WRITING THE THESIS

Students can begin writing their thesis as soon as their project has matured sufficiently, and they have the approval of their committee. Writing and continually revising along the way helps to clarify thinking and creates a better thesis document. The student should not wait for all experiments or analysis to be complete before they begin writing their thesis.

Check the university requirements on the GRADPROG webpage under the resources tab <https://GRADPROGress.sim.byu.edu/resources>. Information includes requirements for format, style, preparing work for departmental approval, and preparing and submitting copies, forms, and fees to the library.

The final version of the thesis should include the following:

1. Title page
2. Abstract page
3. Table of Contents
4. List of Tables
5. List of Figures
6. Thorough introduction, including background information from the published literature.
7. Research chapters*
8. Summary / discussion of findings
9. Complete bibliography

10. Appendices. Unpublished data may also be included.

*A student's published work, including work in preparation for publication, may constitute the research chapters. These manuscripts will typically be inserted as double-spaced text, with figures and tables appropriately embedded.

FINAL RESEARCH REVIEW MEETING

The final review of the student's research is held with the advisory committee (in conjunction with the final semi-annual progress review) to assure both the student and the committee that the body of research is satisfactorily completed, and the writing of the thesis is underway. The student should present a final draft of the thesis to their committee members soon after this meeting. The committee decides if the student is ready to defend and graduate.

This meeting is held prior to scheduling the thesis defense. The recommended time to schedule this review meeting is at the final progress review, which would be in May for students graduating in June or August, or in November for students graduating in December or April.

As with all advisory committee meetings, it is the responsibility of the student to initiate and schedule it.

PRIOR TO DEFENSE

Prior to scheduling the defense, a final copy of the approved thesis must be uploaded in GradProg (<https://GRADPROGress.sim.byu.edu/resources>) under "Ready for Defense." This should be done two weeks prior to the proposed date of the dissertation defense. Once the committee has certified that the student is ready to defend, then the defense may be conducted. It is important to share the date / time of the thesis defense with the Academic Program Coordinator as soon as it is known. The student is responsible to schedule the date, time, and place at least two weeks in advance of the defense. It is mandatory to meet with the Academic Program Coordinator to go over the details of the defense.

THESIS DEFENSE

The thesis defense is conducted when the student has written their thesis and is prepared to defend it. Normally this is during the last semester the student is on campus.

The Thesis Defense consists of two parts:

1. The presentation of the thesis
 - a. The BYU academic community is invited to listen and ask questions at the presentation.
2. The oral defense
 - a. Held immediately after the oral presentation, in a closed session.
 - b. The defense committee asks questions and votes on the student's performance.

Judging the Defense

1. Who:

- a. The exam committee judges the exam. It is made up of the student's advisory committee.
- b. This meeting is conducted by the senior member of the student's advisory committee, who is the longest tenured faculty member in the MMBio department and is not the research advisor.
2. Results: The committee may vote to "pass," "pass with qualifications," "recess," or "fail" the student.
 - a. If the decision is to "pass with qualifications," the advisory committee may require minor revisions of the thesis or strengthening of the candidate's preparation in subject matter areas. When these qualifications are cleared, and the committee has approved the passing of the defense in GradProg, the student is judged to have passed the examination.
 - b. If two or more examiners vote to recess, the examination is stopped and postponed. This permits the candidate to reschedule (with the department and the Office of Graduate Studies) a second and final examination. The new examination cannot be held sooner than one month after the recessed examination. In addition, the second examination must be convened with the original committee. If the student does not pass an exam for a second time, the student will be terminated from the program.
 - c. If two or more examiners vote to fail, the examination is failed, and the graduate degree program of the student is terminated.

The advisory committee will communicate the results of the defense to the Graduate Committee Chair and Academic Program Coordinator. Depending on the results, the advisory committee will assist with any revisions that may be necessary.

AFTER DEFENDING

- Once the defense has been passed, make an electronic copy of your thesis for the library. This is referred to as an ETD. You can find out how to do this at <http://etd.byu.edu>. Please allow yourself several days to complete this requirement.
- Works with the BYU Library and the Academic Program Coordinator on the formatting of the ETD to ensure it is ready to be submitted. Do not submit the ETD until the Academic Program Coordinator gives you approval to do so.
- The ETD is submitted online through GRADPROG and then it must be approved by the department, the Dean's office, and Graduate Studies.
- It is the student's responsibility to monitor the deadlines and to know the requirements of the ETD process. Deadlines can be found on the GRADPROG webpage under the Resources tab <https://GRADPROGress.sim.byu.edu/resources>.
- Check your progress report for any "T" grades given for thesis or research courses. A diploma will not be granted unless these have been changed to passing grades.

CHANGE OF DEGREE LEVEL

PROMOTION FROM MS PROGRAM TO PH.D. PROGRAM

Occasionally, students in the master's (MS) program desire to expand their research into a more substantial body of work and obtain a Ph.D. The Ph.D. degree requires a great deal more time and resource allocation by the student and the research advisor, and more independent intellectual work on the part of the student. Therefore, the MS student must formally apply to the graduate committee for a change of status. To apply for a change in program, the MS student must submit the following documents to the graduate committee (via the Academic Program Coordinator) by January 15:

- Current transcripts from undergraduate and graduate institutions
- Copies of all semi-annual progress review forms from the MS program
- Detailed letter of intent written by the student, including:
 - Reason(s) for wanting to change to the Ph.D. program
 - Status of current research, presented in a way that emphasizes the momentum of the project and the intellectual independence of the applicant
 - Explication of how the MS research project will be elevated / expanded to the level of research that constitutes a Ph.D. dissertation, including anticipated publications or inventions
 - Anticipated date of completion of the Ph.D.
 - Plans after earning the Ph.D.
 - List of current committee members (all of whom should be asked to provide letters of recommendation by the graduate student), as well as one of the following two statements: "I waive my right of access to letters of recommendation" or "I do not waive my right of access to letters of recommendation." The former statement ensures candor on the part of the letter writers and protects confidentiality.
- Letters of recommendation from all committee members. These letters should be given directly to the academic program coordinator and not given to the student requesting a change in program.

After submission of these documents and receipt of letters from committee members, the MS student may be invited to interview with the graduate committee. After careful consideration, the graduate committee will then respond with a formal letter to the applicant indicating either acceptance or denial of the request to change programs. In some cases, a conditional acceptance may be granted, with conditions clearly delineated.

ADDING ADDITIONAL COMMITTEE MEMBERS

Students newly promoted into the Ph.D. program must add an additional committee member to their advisory committee, if there are less than four current members, by October 1. You should visit with your research advisor to discuss those who would be appropriate additions to your committee and refer to "Formation of the Advisory Committee" in this handbook under the Ph.D. Degree Requirements section.

APPROVAL OF AN UPDATED PROSPECTUS

Students newly promoted into the Ph.D. program must update their prospectus to reflect the increased scope of the Ph.D. work. This new prospectus needs to be approved by the advisory committee, with approvals through GRADPROG. The updated prospectus should be approved within six months of the promotion.

QUALIFYING EXAM TIMELINE FOR PROMOTED STUDENTS

Students transitioning from the MS program to the Ph.D. program have one year from the date of transition to complete the qualifying exam.

PARTICIPATION IN THE MMBIO COMMUNITY

GRADUATE STUDENTS ARE EXPECTED TO ATTEND THE FOLLOWING:

- MMBio seminars held during the fall and winter semesters
- Graduate Research in Progress (RIP) meetings held during the fall and winter semesters
- Graduate Retreat held at the conclusion of each summer

Seminars

During the regular academic year, seminars will be held on a weekly basis. In these seminars, scholars from BYU as well as invited guests from other institutions, present cutting-edge research findings. Graduate students will use these seminars as an opportunity to stay current with research in various fields and to learn the art of scientific communication. Opportunities also exist for students to participate in hosting seminar speakers – consult your research advisor for more information. **Less than 75% attendance at seminars will result in a marginal or unsatisfactory progress review.**

Graduate Research in Progress (RIP) meetings

RIP meetings are held regularly during fall and winter semesters. They provide graduate students with an opportunity to practice effective scientific communication and receive feedback on their research work from MMBio faculty and graduate students. Each graduate student can expect to give RIP presentations once or twice per year but is required to attend every meeting. RIP presentations are typically 15-20 minutes in length. The presentation style should emphasize clarity and encourage active participation from the audience. **Less than 75% attendance at RIP meetings will result in a marginal or unsatisfactory progress review.**

Graduate Retreat

A graduate retreat is held annually (just prior to the start of fall semester) to allow each student to present research findings. Presentations are directed to the graduate faculty and to other graduate students and interested individuals. The retreat lasts a full day and **attendance is mandatory.**

OPTIONAL CLUBS:

Life Sciences Graduate Student Club:

A club for graduate students by graduate students! Our goals are to supplement existing graduate programs with activities that encourage career networking / job skills, inter-departmental collaborations, and that increase graduate student social opportunities. Meetings are held monthly and include career panels (talk to the experts!), resume / LinkedIn tutorials, mental health advice, and science writing journal clubs.

If you would like to be involved in planning, brainstorming, or sharing activities, (or if you have a really sweet idea!) please contact the club president at LSGSclub@gmail.com.

BYU Graduate Student Society (BYUSS):

The BYU Graduate Student Society (BYUSS) strives to **enrich**, **enhance**, and **encourage** your graduate school experience by providing opportunities for intellectual growth, professional development, spirituality, and social interaction. Find out more at <http://gss.byu.edu/>.

SUPPLEMENTAL INFORMATION

SOME PEOPLE YOU'LL WANT TO KNOW

- Dr. Scott Weber, Department Chair, 4007B LSB, scott_weber@byu.edu
- Dr. Steven Johnson, Graduate Committee Chair, 3132 LSB, stevenj@byu.edu
- Nancy Morrill, Academic Program Coordinator, 4012 LSB (Academic Advisor), 801-422-4293, nancy_morrill@byu.edu, see for grad questions and forms
- Terri Moser, Business Manager, 4010 LSB (Funding), 801-422-7403, terri_moser@byu.edu, see for financial questions

MMBio DEPARTMENT OFFICES

- 4007 LSB, Office Specialists, 801-422-2889
- 4014 LSB, College Conference Room

GETTING A BYU-ID CARD

- ID Center, 1057 WSC (Wilkinson Student Center)
- Used to check out books in the library, pay for copies, take tests at the Testing Center, or as a “Signature Card” (debit card on campus), as well as for lab / building access.

DEPARTMENT MAILBOX

- Located in 4007 LSB
- Graduate student mail will be placed in your research advisors mailbox in 4007 LSB.

KEYS AND CODES

- Codes: For access to the copy machine, contact your research advisor for research purposes. For department printing, contact the office specialists in 4007 LSB. For access to a lab, contact the faculty member responsible for that lab.

- After-hours access to LSB: obtain authorization from your research advisor. The Life Sciences Building and labs within the building are accessed with a student's BYU-ID card, not a key.

COLLEGE AND DEPARTMENT FACILITIES

- 3057 LSB – In the **Confocal Microscopy Lab** a researcher can capture high-resolution fluorescence data from cells and tissues. The laboratory also provides resources for histological sectioning. Additionally, small aliquots of secondary antibodies may be purchased at low cost. For more information go to <http://confocal.byu.edu>.
- 2142 LSB – The **Computer Center**. Open access during the hours that the building is open. Contains about 24 computers, a printer, and a scanner. Fee charged for scanner use and for copies printed. Your BYU-ID card is used to pay for these items.
- 3118 LSB – The **Research Instrumentation Core Facility (RIC)** houses specialized equipment for use by researchers at BYU. It is equipped with three flow cytometers, Cytospin centrifuge, Sorvall centrifuge, fluorescent plate reader, fluorescence microscope with digital imaging, and Nanodrop spectrophotometer. The RIC also provides access to a new state-of-the-art cell sorter housed in the Benson Building. Dr. Sandra Hope is the Director of the Lab. For further information please visit the website at <http://ricfacility.byu.edu>.
- 4046 LSB – The **DNA Sequencing Center**. Equipment includes the Applied Biosciences 3730xl DNA analyzer for BigDye Sanger sequencing, and the Illumina HiSeq 2500 for deep sequencing applications. The center will soon be acquiring a PacBio Sequel single-molecule, long-read, high throughput sequencing instrument. <http://dnasc.byu.edu/indexResources.asp>

ENROLLMENT AND REGISTRATION REQUIREMENTS

For additional information see the current BYU Graduate Student Catalog

REGISTRATION

Students register for courses online at <https://mymap.byu.edu>.

ENROLLMENT STATUS (FULL-TIME, HALF-TIME, ETC.):

Full-time - U.S. citizens and permanent residents

- To be considered full-time for tuition purposes, students who are U.S. citizens or permanent residents must register for at least 8.5 credit hours in both fall and winter semesters or at least 4.5 credit hours in a term.

Full-time - international students

- International students are required to be registered as full-time students. To be considered full-time for tuition and immigration purposes, international students must register for at least 9.0 credit hours in both fall and winter semesters or at least 4.5 credit hours in a term.

Half-time - U.S. citizens and permanent residents

- A student enrolled in between 4.5 hours and 8.0 hours fall or winter semester or between 2.5 hours and 4.0 credit hours a term is considered a half-time student.

Petition for Graduate Full-Time Status:

- Part-time graduate students who are enrolled for at least 2.0 hours of acceptable credit per semester or one hour per term can be certified by their department as being engaged

full-time in pursuit of their degree and can petition for graduate full-time status using [ADV Form 2a](#). Acceptable credit may include thesis, dissertation, project, research, or internship hours.

- Full time pursuit of a degree means the student is devoting 40 or more hours per week to fulfilling graduate degree requirements during the semester in question. To be eligible for Graduate Full-Time Status:
 - The student is not working at a full-time job.
 - The department limits the student's enrollment to less than full time because of a required TA/RA assignment. The combination of TA/RA assignment and registration must be equivalent to a full-time load.
 - The student has completed all the required course work for the degree and is working full-time on the dissertation, thesis, project, or internship.

CONTINUOUS ENROLLMENT

The department expects graduate students to be continuously enrolled until all program requirements are completed.

- **New students:** must enroll for at least 2 credits in the first semester or term of their graduate program.
- **Everyone:**
 - Enroll in a minimum of 6 credits per academic year
 - If admitted winter, 4 credits for academic year (first year only)
 - If admitted spring or summer, 2 credits for academic year (first year only)
 - Receive acceptable grades (no grade lower than a B-, UW's or I's). If an unacceptable grade is received, a student will receive an unsatisfactory at their next progress review meeting.
 - Satisfactory required semi-annual progress reports
- **Ph.D. candidates:** In addition to the above requirements, Ph.D. candidates must fulfill a residency requirement by registering for at least two consecutive 6 credit semesters on BYU campus during their program.
- **International students:** Immigration law requires minimum enrollment of 9 credits each fall and 9 credits each winter, until all class work is completed. Then minimum enrollment is 2 credits each fall and each winter semester. Immigration does not require Spring & Summer enrollment; however, you must still have the minimum of 6 credits per year to fulfill the university requirement.

GRADUATE STUDENT WORK ELIGIBILITY GUIDELINES

If you are hired as a Teaching Assistant (TA), Research Assistant (RA), or paid a research stipend, you must meet these guidelines in addition to the Graduate Studies guidelines on Continuous Enrollment. Students need research advisor approval before applying for TA, RA, or other jobs on campus.

Fall & Winter Semesters:

U.S. Citizens:

- Must carry at least 2 day-continuing credit hours during Fall and Winter semesters.

International Students:

- Must carry at least 9 day-continuing credit hours during Fall and Winter semesters until coursework is complete, then must carry at least 2 day-continuing credit hours during Fall and Winter semesters.

Spring & Summer Terms:

U.S. Citizens:

- Must carry either a combined total of 1 credit Spring and Summer, or a minimum of 2 for the following Fall semester.

International Students:

- Must carry either a total of 4.5 credits each term for Spring and Summer or be on an approved vacation and have a minimum of 9 credits for the following Fall semester until coursework is complete, then must carry at least 2 day-continuing credit hours the following Fall semester.

LOSS OF CONTINUING STATUS

If continuous status is lost, you will need to:

- Fill out an “Application to Resume Graduate Study” form GS6 and pay a non-refundable \$600.00 fee.
- Submit a “Reapplication Honor Code Commitment & Ecclesiastical Endorsement” form GS6a.
- If international, submit new financial certification forms, GS form I-1 and I-2.
- Register for at least 2 credits for the term in which you are readmitted.

Note that students who are not approved for readmission through the process above, can apply to the same graduate program through the regular online submission process, but no previous course work will be considered on the new program of study.

LAST SEMESTER

- Two-hour minimum registration is required for all graduate students during the semester or term in which the student defends their thesis / dissertation and finishes the graduate program. If a student is finishing in August, they may register for 2 hours in spring term, 2 hours in summer term, or 1 hour in each spring & summer term. Every student must have a minimum of six credits the year they graduate. If a student is graduating in June, then only 1 hour is required in spring term.
- Students must have a current ecclesiastical endorsement for the semester / term in which they graduate.

GRADUATION DATES

BYU students can graduate in April, June, August, and December of each year. However, convocation and commencement will only be held in conjunction with April graduation. Those graduating in June, August, or December may attend convocation and commencement with those graduating immediately prior or after their graduation.

FINANCIAL ASSISTANCE

PH.D. STUDENTS:

Ph.D. students receive a stipend and full tuition coverage for their program classes. To receive continued departmental funding, these students must:

1. Be a degree-seeking, continuously enrolled Ph.D. graduate student
2. Have and maintain a 3.0 GPA (cumulative program GPA)
3. Maintain satisfactory progress towards their degree
4. Choose appropriate lab (Note: the department cannot fund more than one Ph.D. student per lab, and Ph.D. projects can be expensive for supplies as well. Therefore, if a student wishes to join a lab, the faculty member must have funding to support the student).
5. Students should be registered for a minimum of 2 hours of credit each fall and each winter semester and need a total of 6.0 credits per academic year to keep graduate student status (September to August).

Stipend: Stipends are funded in one of two modes: department or external. The total stipend amount is \$8,500 per semester (F, W, Sp/Su contracts); for a total of \$25,500 per year. Students under contract are required to abide by the university student employment policies.

Tuition Scholarship: Tuition is funded by the department to pay for courses related to the student's degree only (on the student's program of study list). If a student desires to take a course for personal interest, they will need to pay for it. However, if a student is enrolled full-time (8.5 credits per semester [9 credits per semester for international students] or 4.5 credits per term) they may elect to add a class of their choice, since there will be no added tuition costs to the department.

All Ph.D. students whose tuition is covered by the department, regardless of funding source, are expected to TA for one semester per year. Additionally, all Ph.D. students regardless of funding sources are expected to TA once during their program.

All graduate students may attend religion courses without cost or credit by completing the "Graduate Student Request for No-Cost/No-Credit Religion Course" form found on the Grad Studies Website.

MASTERS STUDENTS:

Master's students are not guaranteed financial assistance, but should consider opportunities to TA or RA, access temporary departmental assistance, or access assistance from external funding that may be available through the research advisor. They are also encouraged to apply for university, college, and departmental scholarships.

LENGTH OF TIME FOR DEPARTMENTAL SUPPORT

The maximum length of time a student may receive financial support from the department is six years (18 semesters) for Ph.D. students. Support is always contingent upon receiving satisfactory status and a 3.0 GPA. Students changing from MS to Ph.D. need to consult with the department on the length of time for departmental support.

NON-DEPARTMENT FINANCIAL AID

BYU Financial Aid Office offers loans, including short term and Stafford Loans. BYU Graduate Studies Office offers research fellowship awards and mentoring grants. Some of the scholarships listed on Prestigious Scholarships website are also available for graduate students. You may also check with faculty members for other externally funded projects.

Stafford loans will require students to start paying back loans, if registered for less than half time (4.5 credits in a semester). Other loans may have required enrollment qualifications. The Financial Aid Office can tell you if you qualify for exceptions, in which case you can petition for full-time status.

STUDENT OUTSIDE EMPLOYMENT

Outside employment is discouraged. Maximum time and resources should be used for student progress toward a degree. However, if it is necessary, a short memo from the student with endorsement by their research advisor should be submitted for approval to the Graduate Committee Chair. It should also be noted that BYU policy does not allow a student to work for more than one church employer at a time (examples of other church employers include Deseret Book, Church offices, other church schools, etc.)

OTHER POLICIES

HEALTH INSURANCE

BYU requires all full-time graduate students to be insured. If you have private insurance, please provide that information to BYU through My Financial Center (mfc.byu.edu). BYU offers an annual insurance policy through the Student Health Program. Current premium rates can be found at: <http://health.byu.edu>. BYU insurance DOES NOT MEET ACA REQUIREMENTS so students should understand insurance needs and requirements before choosing a health plan.

INTERNATIONAL STUDENTS

An international graduate student is required to enroll in at least 9 semester hours of credit each fall and each winter semester. Once all course work is complete, the student should request that the Academic Program Coordinator communicate to the International Office certifying that all course work is complete. The student may then enroll for only research (695R), thesis (699R) or dissertation (799R) credit, which may be as few as two credits per semester.

The International Office (as required by Immigration and Naturalization rules) does not require spring and/or summer enrollment. However, international students must still comply with university requirements of registering for at least 6 credit-hours per academic year (September through August).

International students can only work a maximum of 20 hours per week during the fall and winter semesters. See the International Office regarding any other limitations or restrictions.

An international student should keep in contact with the International Services Office for the varying requirements of the Immigration and Naturalization Office and their respective

countries. The International Services Office is at 2400 WSC, phone number 801-422-2695, email at intloff@byu.edu, and website at www.international.byu.edu.

MATERNITY LEAVE

It is the student's responsibility to coordinate their maternity leave with their research advisor and the Graduate Committee Chair, including any necessary paperwork if the student intends for an extended leave. Maternity leave is not considered medical leave at the university and is solely dependent on the research advisor and the Graduate Committee Chair for approval.

INTERRUPTION OR TERMINATION OF PROGRAM

Students must get approval from the Department Chair and Graduate Committee Chair before they interrupt their graduate program. The length of time from the start of graduate study, the interrupted time, and the completion of the degree must be within the university's degree time limits, which are five years for MS programs and eight years for Ph.D. programs.

A student may then resume study with:

- Approval of the Department Chair and Graduate Dean
- Submission of Form 1a, Application to Resume Graduate Study
- A \$125.00 non-refundable processing fee
- Reapplication of Honor Code Commitment form
- New Financial Certification form (for international students)

A student who wishes to terminate or withdraw, should contact their research advisor first and then the Academic Program Coordinator.

Once enrolled, a graduate student loses eligibility to register if:

1. The student has not fulfilled the minimum registration requirement (6 hours per academic year).
2. The student has not submitted a program of study as required: master's students by the third week of the second semester after admission; doctoral students by the third week of the beginning of the second year.
3. Graduate Studies has not received official transcripts showing that the required prerequisite degrees have been conferred.
4. The student's time limit has expired.
5. The student has received two unacceptable evaluations in succession.
6. The student has withdrawn or has been terminated by the department.
7. The student has violated the BYU Honor Code and is not cleared by the Honor Code Office.
8. The student has failed to submit an annual continuing ecclesiastical endorsement.
9. The student has graduated from the graduate program.

Termination of graduate status may result if a student:

1. Fails to satisfactorily complete the conditions of acceptance.
2. Fails to fulfill the university's minimum registration requirements.
3. Makes a request to withdraw (with the intent to pursue a degree at another university, for personal reasons, or in response to department recommendation).

4. Receives two consecutive marginal and/or unsatisfactory ratings in a semi-annual progress review and/or is unable or unwilling to comply with conditions placed upon them.
5. Fails to make satisfactory progress toward a graduate degree, as deemed by the department or university.
6. Fails the departmental qualifying exam including grant proposal requirements (for a Ph.D. degree student) or coursework oral exam (for master's degree students)
7. Fails the thesis defense or dissertation defense.
8. Violates the university's standards of conduct or Honor Code.
9. Exceeds the time limit (five years for master's, eight years for doctoral).

A student may request a review of termination by contacting the Department Chair in writing. A student who has made significant progress on a Ph.D. degree but is terminated from that program, can petition to convert to a master's program. A student who wishes further consideration may request review by the College Dean. A final request for review may be made to the university Graduate Dean.

UNIVERSITY POLICIES

Brigham Young University desires to provide personnel and students with a work and academic environment free from discrimination, including any form of unlawful sexual harassment or inappropriate gender-based behavior. If you encounter sexual harassment or gender-based discrimination, please talk to your Department Chair, contact the Equal Opportunity Office at 422-5895, or contact the Honor Code Office at 422-2847.

Students are expected to uphold the honor code commitment while attending Brigham Young University. This includes honesty; obeying the laws and campus policy; living a chaste and virtuous life; respecting others, abstaining from alcohol, tobacco, coffee, and abusive substances; and encouraging others. The Honor Code is online at http://honorcode.byu.edu/The_Honor_Code.htm.

BYU is committed to providing reasonable accommodation to qualified persons with disabilities. If you have any disability that may adversely affect your success, please contact the University Accessibility Center at 422-2767. Services deemed appropriate will be coordinated with the department.

Plagiarism of any kind is completely contrary to the established practices of higher education, where all members of the university are expected to acknowledge the original intellectual work of others that is included in one's own work. Intentional plagiarism is a form of intellectual theft that violates widely recognized principles of academic integrity as well as the Honor Code. Such plagiarism may subject the student to appropriate disciplinary action administered through the university Honor Code Office, in addition to academic sanctions that may be applied by the department. Inadvertent plagiarism, whereas not in violation of the Honor Code, is nevertheless a form of intellectual carelessness that is unacceptable in the academic community.

Brigham Young University is an educational institution affiliated with The Church of Jesus Christ of Latter-day Saints. Within this context of religious preference, Brigham Young University considers equal opportunity and nondiscrimination to be fundamental to its mission, goals, and objectives.

LIST OF FORMS

Form	What is it used for	When to use it	Where to find it
ADV Form 2a: Request for Graduate Full-time Status	If registered for fewer than 8.5 hours/semester or 4.5 hours/term and you need the university to verify that you are a full-time student	After completion of required course work and you are working on your thesis or dissertation	In GRADPROG under Resources, then Forms
ADV Form 5: Leave of Absence	If you need to request a leave of absence for Medical (non-maternity), Military, or Mission	If you need to request a leave of absence from your program	
ADV Form 6: Graduate Student Request for Religion Course	To audit a religion class and not have to pay	Whenever you want to take a religion class	
ADV Form 8g: Letter of Completion Request	To request a letter of completion for business, educational or international status needs	If a letter of completion is needed prior to the official awarding of the degree	
GS Form 6: Application to Resume Graduate Study	To request to return to your program of study after a leave of absence	When you are ready to resume your graduate study after a leave of absence	
Choose Committee Members	Add committee members	Ph.D. – Progress Review #2 Masters – Progress Review #1	
Program of Study	Add your program courses	Ph.D. – Progress Review #2 Masters – Progress Review #1	
Program of Study change	To change courses or committee members	As needed	Academic Program Coordinator, 4012 LSB
Schedule of Final Oral Exam	Date, place & title for dissertation/thesis defense	At least 2 weeks prior to dissertation/thesis defense	
Approval of Dissertation/Thesis	Confirming passing of dissertation/thesis	At the defense	Completed in GRADPROG
Standards for Dissertation/Thesis	Format and paper requirements for dissertation/thesis	Before you begin writing your thesis or dissertation	Academic Program Coordinator, 4012 LSB
Thesis/Dissertation Templates & Examples	Template for writing dissertation/thesis	Before you begin writing your thesis or dissertation	
Graduation Deadlines	Make sure you meet university deadlines	When you start planning to graduate	
Thesis & Dissertation checklist	Checklist for submitting dissertation/thesis and graduating	Last semester when you start planning to graduate	Academic Program Coordinator, 4012 LSB
Form A: Graduate Progress Review	Confirm committee reviews held	November and May of each year	
Form B: Prospectus Document	Committee approves your Prospectus	Ph.D. – 3 rd Progress Review Masters – 2 nd Progress Review	
Form C: MS Coursework Exam	Committee rules on coursework exam	Masters – 4 th Progress Review	
Form D: Ph.D. Qualifying Exam	Committee rules on comprehensive exam	Ph.D. – 4 th Progress Review	
Form E: Action after Marginal or Unsatisfactory Progress Review	Student Action plan and how it was accomplished to return to Satisfactory progress	Six months after a Marginal or Unsatisfactory Progress Review	

GRADUATE COURSES LIST

MMBIO Course	Title	Credit Hours	Offered	Description
BIO 503	Research Orientation	1	Fall	Introduction to graduate school and research techniques.
CELL 570	Responsible Conduct of Research	1	Winter	Instructs students on ethical and responsible conduct on topics such as experimental design, data acquisition, professional and collaborative relationships, authorship, and scientific outreach.
510	History and Philosophy of Microbiology & Molecular Biology	2	Fall	Exploring the historical and philosophical context of great discoveries in microbiology and molecular biology through readings, group discussion, and analytical writing.
518	Select Pathogens	2	Winter	Current literature dealing with special pathogens.
522	Flow Cytometry	2	Fall	Explore the theory and instrumentation of flow cytometry, including current applications and hands-on training.
528	Scientific Literacy	1	Fall	Trends from current literature on pathogenesis of infectious diseases.
551R	Current Topics in MMBIO	1-3	On demand	Readings from current literature on a specific topic; student presentations and discussions.
660	Microbiology and Immunology	3	Fall	This course covers the core fundamentals of immunology, bacteriology, and virology (which are necessary for a graduate degree in microbiology and molecular biology.)
661	Molecular Genetics in Practice	2	Fall	Fundamental concepts in molecular cell biology with an emphasis on model organisms and experimental approaches including plasmid-based tools, gene manipulation, protein analysis, microscopy, and genomics.
663	Articulating Science	2	Winter	Students will practice identifying open scientific questions and describing context, impact, and detailed experimental research plans.
665	Genomics	3	Winter	Strategies and methods for genomic studies, emphasizing experimental design and computational and statistical approaches for analyzing data.
667	Special Topic – Quantitative Genomics	2	Fall	Students will understand, evaluate, and apply common genomic/transcriptomic methods, which will facilitate processing and interpreting results from large datasets in a biologically meaningful way.
691R	Graduate Seminar	1	Fall / Winter	Presentations by selected speakers from the College, Department, and outside of the university.
692R	Research in Progress	1	Fall / Winter	Graduate student research presentations. Weekly meetings highlighting current progress and discussion-based feedback from faculty and student peers.
695R	Research	1-18	Fall / Winter / Spring / Summer	Graduate students will work on completing their research projects, give presentations at meetings, and write and publish papers.
699R	Master's Thesis	1-9	Fall / Winter / Spring / Summer	Master students will write, format, defend, and submit their master's thesis.
799R	Ph.D. Dissertation	1-9	Fall / Winter / Spring / Summer	Ph.D. students will write, format, defend, and submit their Ph.D. dissertation.

GRADUATE FACULTY LIST

Faculty	Phone 801-422-	Office LSB	Ph.D. Date and Institution	Research Specialty
Brad Berges	8112	3136	2005 – University of Pennsylvania	Humanized mouse models, bacterial pathogenesis
Donald P. Breakwell	2378	2135	1992 – Purdue University	Soil microbiology; microbiology education
Mary Davis	6207	3129	2013 – Vanderbilt University	Genetic analysis, records-based medical research
David Erickson	1981	3133	2003 – University of Calgary	Bacterial pathogenesis
R. Paul Evans	3259	3139	1983 – Medical College of Virginia	Molecular biology
Joel Griffitts	7997	3130	2004 – University of California, San Diego	Plant-microbe interactions, antibiotic synthesis
Julianne Grose	4940	2400 WSC	2003 – University of Utah	Yeast carbon metabolism
Sandra Hope	1310	3134	2000 – University of Kentucky	Immunology, bacteriophage biology
Steven Johnson	9170	3132	2004 – Yale University	Nucleosomes, chromatin, and epigenetics
Kim L. O’Neill	2449	3142	1986 – New University of Ulster, Northern Ireland	Oncology, immunology
Brett E. Pickett	2506	3141	2010 – University of Alabama, Birmingham	Comparative genomics & infection/cancer
Brian Poole	8092	3138	2004 – Pennsylvania State University	Cell-virus interactions
Richard A. Robison	2416	3131	1988 – Brigham Young University	Bacterial pathogenesis, host immune responses
Jeffrey K. Schachterle	6020	3128	2019 – Michigan State University	Virulence of phytopathogenic bacteria
Scott Weber	6259	3137 / 4007B	2005 – University of Illinois	T cell immunology
Eric Wilson	4138	3135	2000 – Montana State University	Immunology