

Master of Science in Biomedical Sciences
Student Handbook
2019



Biochemistry and Molecular Biology
Cell and Molecular Pharmacology and Experimental Therapeutics
Public Health Sciences/ Biostatistics and Epidemiology
Microbiology and Immunology
Neuroscience
Pathology and Laboratory Medicine
Regenerative Medicine and Cell Biology



Overview

The College of Graduate Studies at the Medical University of South Carolina offers degree programs that prepare students for careers as research scientists, investigators, or teachers, depending on the extent of training.

The **Master of Science in Biomedical Sciences (MSBS)** is a research-intensive degree program requiring completion of an independent laboratory research project under the direction of a faculty advisor in a student's chosen field, a written thesis, and an oral thesis defense. Students choose one of seven tracks as their field of concentration:

Tracks of concentration for the MSBS program

- 1) Biochemistry and Molecular Biology
- 2) Cell and Molecular Pharmacology and Experimental Therapeutics
- 3) Microbiology and Immunology
- 4) Neurosciences
- 5) Pathology and Laboratory Medicine
- 6) Public Health Sciences*
- 7) Regenerative Medicine and Cell Biology

*Due to significant differences in structure between the Public Health Sciences degree requirements and the other MSBS tracks, students in this track should not use this handbook, but instead should consult the [Department of Public Health Sciences Student handbook posted online](#). DPHS courses are open to MS students in any track, provided that the prerequisite requirements are met.

The Master of Science in Biomedical Sciences degree program is overseen by the Master of Science in Biomedical Sciences Program Committee, consisting of a Chair appointed by the Dean of the College of Graduate Studies, the Graduate Program Director for each track, and a student representative. The 2018 MSBS Program Committee roster is in the table below:

2018 Master in Biomedical Sciences Program Committee

Program Committee Chair	Laura Kasman, Ph.D.	kasmanL@musc.edu
Biochemistry and Molecular Biology	David Long, Ph.D.	longdt@musc.edu
Cell and Molecular Pharmacology and Experimental Therapeutics	John O'Bryan, Ph.D.	obryanjo@musc.edu
Microbiology and Immunology	Chentha Vasu, Ph.D.	vasu@musc.edu
Neurosciences	Brett Froeliger, Ph.D.	froelige@musc.edu
Pathology and Laboratory Medicine	David Turner, Ph.D.	turnerda@musc.edu
Public Health Sciences	Mulugeta Gebregziabher, Ph.D.	gebregz@musc.edu
Regenerative Medicine and Cell Biology	Russell Norris, Ph.D.	norrisra@musc.edu
Student Representative	T.B.D.	

Degree Requirements

The College of Graduate Studies has specific course requirements and proficiency standards for the Master of Science in Biomedical Sciences degree. All tracks require completion of an original laboratory research project under the direction of a faculty member (Major Advisor) in their chosen field, written thesis, and oral thesis defense. MSBS students are required to register for a minimum of nine hours each semester including the summer between first and second year. Coursework of at least 42 total credit hours, including a minimum of 15 hours of didactic (non-research, non-thesis) instruction is required. Track specific course requirements are described in *Appendix 1*. With regard to electives, each student follows an individual *Program of Study* designed in consultation with their Major Advisor.

Graduate students are expected to **maintain at least a 3.0 overall grade point average** in merit-graded courses and a passing grade in all research and Pass/Fail courses, in order to satisfy the required graduate credit hours. This represents the minimum requirement of the College. Individual programs may have more stringent requirements for continuation as a graduate student. A student whose total cumulative record is below these requirements at the end of any semester is placed on Academic Probationary status and is given until the end of the next fall or spring semester, whichever comes first, to bring the cumulative average back to the required standard. If by the end of the following semester the required level has not been attained, the student is eligible for dismissal. At the discretion of the MSBS Program Committee, and contingent upon satisfactory research progress, 12 credit hours of merit-graded coursework in which a grade of at least 3.0 has been earned may be substituted for the cumulative GPA requirement.

Timeline

The MSBS program is expected to last two fall semesters, two spring semesters and one summer, so that a degree can be obtained 21 months after the start of the program. The timeline below is recommended for students wishing to finish within this time frame.

Recommended Timeline

	Fall term 1	Spring term 1	Summer	Fall term 2	Spring term 2
Courses	Common first year graduate curriculum* and Research (970)	CGS 770 Principals, Practices & Professionalism, optional electives, and Research (970)	Writing for the M.S. (CGS 762)	Research (970) Optional electives	Research (970) Optional electives
Other milestones	Two 6-wk lab rotations (see note next page). Choose Major/Thesis Advisor by end of semester.	Start thesis research project in chosen laboratory. Meet with Thesis Advisory Committee to approve research Specific Aims.	Writing of thesis proposal in CGS 762 course.	Defend thesis proposal by October 1st. Admission to candidacy for M.S. degree.	Finish research. Write thesis. Defend thesis. Graduate!
CGS forms to submit	<ul style="list-style-type: none"> ✓ Rotation agreement forms ✓ Appointment of Major/Thesis Advisor 	<ul style="list-style-type: none"> ✓ Selection of Thesis Advisory Committee ✓ Program of Study ✓ Evaluation of Student Progress 	<ul style="list-style-type: none"> ✓ Individual Development Plan, if not completed in CGS 770 	<ul style="list-style-type: none"> ✓ Plan of Research ✓ Admission to Candidacy ✓ Evaluation of Student Progress 	<ul style="list-style-type: none"> ✓ Thesis Defense Notification ✓ Successful Defense

*See appendix

Full time enrollment

Master in Biomedical Sciences students are required to enroll for a minimum of 9 credit hours per term, including the summer between first and second year. Masters students must enroll in at least 1 credit hour of Research per term (course number 970-*Research*), or if all experiments are completed, Thesis (course number 980-*Thesis*).

Laboratory rotations

Two laboratory rotations in the first semester are highly recommended for all tracks, except the Department of Public Health Sciences. Research laboratories vary in many ways besides the focus of research. Therefore, a recommended first step in the MS program is to experience *at least* two laboratory environments and mentor styles, prior to choosing a mentor. Rotations may be in labs associated with any track. MSBS lab rotation hours should be accounted for under Research credit hours (CGS 970). MSBS students *do not* register for CGS 720/721, Ph.D. lab rotations, which is a year-long course. When a student starts a rotation, they are required to complete an MSBS Rotation Agreement form with their mentor (*see Appendix 2*). Prior research experiences at MUSC or elsewhere may take the place of laboratory rotations at the permission of the MSBS Program Committee.

Table of Lab Rotation Requirements by track:

<i>Track</i>	<i>Lab rotation requirement</i>	<i>Course number to register for lab rotations</i>
Biochemistry and Molecular Biology	Two 6-week rotations in the first semester	BMB 970
Cell and Molecular Pharmacology and Experimental Therapeutics	Dates for Fall 2019	PCOL 970
Microbiology and Immunology		MBIM 970
Pathology and Laboratory Medicine	Rotation 1: Sept 16 - Oct 25	PATH 970
Regenerative Medicine and Cell Biology	Students may rotate in labs in different tracks	CELL 970
Neurosciences		NSCS 970
Public Health Sciences	None. Mentors chosen after spring of 1 st year.	BMTRY 970

Program of Study

The *Program of Study* is a list of courses and other requirements (including those of the major department) that the student must complete in order to meet the minimum requirements of their degree. It lists courses that are being transferred (rarely applicable), as well as courses that are to be taken on campus. It is planned in a meeting of the student and his/her Major Advisor. After approval by the Major Advisor, the approved *Program of Study* form is reviewed with the Graduate Program Director for the student's chosen track, who must also approve it, and then filed with the Office of the Dean of Graduate Studies. This should occur within three months of the Major Advisor being chosen. A decision to remove, substitute, or add courses to the program can be made in a joint meeting of the student and the Major Advisor. Any changes in the program must be completed no later than one week after the substituted or additional course has begun. A record of any change in the program will be submitted by the Major Advisor to ensure that any change in the *Program of*

Study is consistent with the maintenance of at least the minimum course requirements of the major department. Ordinarily, only courses listed in the catalog of the College of Graduate Studies will be included in the program. The program must be completed before the final oral examination is scheduled.

Taking the Ph.D. First Year Curriculum as an MS in Biomedical Sciences student

The fall course requirements for MS in Biomedical Sciences students in all tracks except DPHS, are the same as for the Ph.D. in Biomedical Sciences students. The only exception is that M.S. in Biomedical Sciences students do not enroll in the Laboratory Rotations course, CGS 720. Students may apply to the MS in Biomedical Sciences Program Committee for permission to follow an alternative first semester Program of Study. Interested students should contact the program committee chair for more information.

Auditing Courses

Any graduate student, with permission of the instructor and their Major Advisor, and with written notice to the Graduate Office, may audit a course. Audited courses are not part of the *Program of Study* and will not be given credit.

Repeating Courses

The Thesis Advisory Committee may permit a student to repeat a course in order to raise the grade. In accordance with the MUSC Bulletin, courses that have been repeated will be treated as follows: (1) Credit hours will be granted only once. (In computing the overall grade point average to determine eligibility for degrees or in rulings on probationary matters, the credit hours must be counted twice and both grades included). (2) The transcript must show both grades, with the second being designated as *Repeated*, and credit hours being given only once.

Transfer Credit

As stated in the MUSC Bulletin, at least 33 percent of semester credit hours applied toward a Medical University degree must be earned through instruction by the University. Only those courses (none from correspondence or research) in which grades of 3.0 or above were received will be acceptable for transfer on the *Program of Study*. In some instances, the department may request that a student transfer hours received in certain courses that have been taken on a pass/fail basis, but these cannot be averaged in the GPA. It is the responsibility of the department to determine the student's comprehension of the material before such hours are shown on the *Program of Study* for credit toward the degree.

Individual Development Plan Requirement

In accordance with the CGS Individual Development Plan (IDP) policy, MSBS students are required to complete an Individual Development Plan within 3 months of choosing a Major Advisor and no later than the end of their first year. Its purpose is to ensure that MSBS students begin post-graduation career planning early in their training and identify their training goals early. Review of the IDP with the Major Advisor and/or thesis committee shall take place annually and be noted on the Evaluation of Student Progress form. The CGS IDP assessment is titled [CGS Graduate Student IDP Worksheet](#) and is available on the College's website under [links for current students](#).

Thesis Advisory Committee

This committee, which is recommended by the major department and approved by the Dean, shall consist of at least four faculty members, including at least one from outside the department. All members of the committee shall be members of the Graduate Faculty. The student's Major Advisor (Thesis Mentor) typically serves as Chair of the committee. The Advisory Committee Chair must either be a full member of the Graduate Faculty, or an associate member with a full member as the student's co-mentor. The Thesis Advisory Committee should be appointed after a student has chosen a specialized area in his/her field and no later than 6 months after the student enrolls (end of February of first year). Until then, the student will be advised by the departmental Graduate Program Director or Major Advisor.

Plan of Research (Research Proposal)

Prior to being certified as a candidate for the M.S. in Biomedical Sciences degree, each student will submit a research proposal on the proposed thesis topic to their Thesis Advisory Committee in NIH style grant format (Page limits for single-spaced text with 0.5 inch margins: Specific Aims – 1 page, Research Strategy – 6 pages, Literature Cited – no page limit). The required summer course for MSBS students, CGS 762, provides instruction for this task. **The Specific Aims for each MSBS thesis shall be approved by the student's Thesis Advisory Committee in a meeting that takes place no later than the last day of the spring term of the student's first year.** The committee's approval shall be indicated by their signatures on an Evaluation of Student Progress form to which is attached a copy of the approved Specific Aims.

Proposal Defense

The student must distribute their research proposal to their Thesis Advisory Committee at least 7 days before the scheduled Proposal Defense. The Thesis Advisory Committee will critically review the written proposal. In addition, the student will orally present and defend the research proposal before his or her Thesis Advisory Committee. The student will be questioned on those methodologies and background areas needed to understand and successfully complete the proposed research. **The MS proposal defense should be completed by October 1st of the student's second year.**

Admission to Candidacy

Upon approval of the research proposal and its successful defense, the student will be certified as a candidate for the M.S. degree by the signing of the *Admission to Candidacy-Masters* form by at least four members of the Thesis Advisory Committee. Admission to candidacy should occur before October 1 of the student's second year, and must occur at least three months prior to completing requirements for the degree.

The graduate school recognizes that the student's research may deviate substantially from that originally proposed. The student should be encouraged to pursue promising leads; however, long-term changes in the direction of the student's research should only occur in consultation with their Thesis Advisory Committee. An Evaluation of Student Progress Form should be filled out and submitted at the time of the proposal defense and at every meeting of the student and their Advisory Committee as a record of the meeting. The committee will recommend the time until the next meeting on this form.

Policy on the submission and completion of the thesis

A thesis, contributing new knowledge or the treatment of familiar materials from a new point of view, is required on a topic in the major field. Students should prepare their thesis according to [CGS guidelines](#) and any additional requirements of their Program. Prior to confirming a Thesis Defense date, the thesis must be certified as ready to defend by the Major Advisor and Graduate Program Director. Once the student is ready to defend, the completed "Notification of Defense" form, signed by the student's Major Advisor(s) and Graduate Program Director, should be sent to the Dean's office at least three (3) weeks prior to the public seminar and private defense date.

All committee members should be given the complete dissertation no later than two (2) weeks before the oral defense to ensure that they have time to read it. After the defense is completed, it is common for corrections and revisions of the draft thesis to be required by Thesis Advisory Committee members. Students will be given clear written instructions from their committee members and major advisor (at, or within 48h of, the defense) regarding the changes that need to be made to the thesis before it can be accepted. Upon receiving these comments, students will then have three (3) weeks, or until the last day of classes for the term (whichever comes first) to make all corrections, show them to each of the committee members, and collect the signatures of each on the title page of the thesis.

Upon obtaining final approval via signature on the title page from each member of their committee, the "Successful Defense" form will be completed and submitted to the College of Graduate Studies along with the signed title page with original signatures to the Dean's Office.

The College of Graduate Studies requires all students to upload the final version of their Thesis/Dissertation to MEDICA at <http://medica.library.musc.edu/submit> as fulfillment of his/her degree requirements. The title page submitted to MEDICA should have typed committee names only, no signatures, for security purposes. Students who would like bound copies of their Thesis/Dissertation for their personal use or for the department may purchase them directly from the vendor. <http://www.houchenbindery.com/on-demand-printing-order/>

You have the option of placing the release of your document under embargo, which means that until a specified period of time has elapsed; your document will not be accessible. You have the choice of making your Thesis available to only MUSC users (with NetID/password) for either a fixed period of time or permanently.

Instructions for how to turn in the final, approved and signed version of the thesis are available on the College of Graduate Studies website. Submission is electronic and a paper copy of the title page only, with original signatures, must be turned in to the College of Graduate Studies Registrar (Dodie Weise) at the time of electronic submission, along with a form granting or withholding permission for online publication of the thesis. The M.S. degree is not awarded until the College of Graduate Studies Dean's Office has confirmation of both a successful defense and the submission of the final thesis to MEDICA.

The final, approved, and signed version of the thesis MUST be electronically submitted to MEDICA seven days before the last day of the semester in order to graduate that semester (April 23, August 7, and Dec 23 for spring, summer, and fall graduation respectively). Students who do not submit their thesis by this time will be required to register for the next semester at their own expense for a minimum of one hour and will receive that semester as their completion date.

Final Examination (Thesis Defense)

Each candidate is required to pass a general oral examination (Thesis Defense) covering the major field and the thesis. This shall begin with a formal presentation open to the public with appropriate slides and shall be at least 20 minutes in length for the M.S. candidate. The examination portion of the defense is conducted by the Thesis Advisory Committee, with its Chairperson presiding and is closed except to Graduate Faculty.

The Thesis Advisory Committee will have primary responsibility for evaluating the student's research, including the written thesis and formal oral presentation, and for administering the final oral examination.

Upon completion of the defense, each committee member will fill out a ***Defense Rubric form*** and give it to the Major Advisor. The Major Advisor will in turn collate the evaluations into one form, discuss it with the trainee and then submit it to the College's Registrar.

Approval by the Thesis Advisory Committee, with no more than one dissenting vote, is necessary for recommendation of awarding the degree. The decision of the Thesis Advisory Committee will be indicated by their signatures on the *Certification of Successful Defense* form and forwarded to the Dean of the College of Graduate Studies. The Graduate Faculty has the authority, which it has delegated to the Dean, for final approval of the candidate for the awarding of the degree.

In the event that a student fails to pass the thesis defense, only one opportunity for re-examination shall be given, at a time determined by the Thesis Advisory Committee but not more than one year from the time of the final examination at which this decision was made. Any candidate who is granted the privilege of re-examination shall retain the status and obligations of a graduate student until the time of such re-examination.

Research Presentation Requirement

During the course of their degree program, students are required to make a research presentation on campus or at a scientific conference, in a manner to be determined by the department or program. Examples of presentations that fulfill this requirement include MUSC Research Day posters and oral presentations, presentations as part of departmental seminar series, the Hollings Cancer Center retreats, and any other presentation on the student's research that is open to the public or all attendees at a conference. A limited number of student travel grants up to \$500 may be available from the Graduate Student Association and the College of Graduate Studies for presentation at conferences. MSBS students who have an opportunity to present their work at a scientific conference may apply. Interested students should contact the MSBS Program Committee Chair, Laura Kasman.

Commencement (Graduation Ceremony)

Diplomas are awarded three times per year, in August, December, and May, but the only Graduation Ceremony for MUSC graduates is in May. Degree candidates wishing to participate in the Hooding Ceremony and or the Graduation Ceremony must complete all requirements, including submission of the final approved thesis, prior to the last day of class for the appropriate Spring Semester. The Hooding Ceremony and a Day of Celebration for the graduates take place on the Thursday before the University Commencement on Friday. Refer to the University Academic Calendar for the dates in a given year. The *Degree Application/Graduation Order* form should be completed the semester before the student plans to fulfill all requirements for their degree. The deadline for ordering regalia is the preceding January 1st.

Time Limit

The M.S. in Biomedical Sciences degree is a two-year course of study. All requirements must be fulfilled within a period of three years following initial registration, although course credit is not nullified until six years after completion of a course. Any student who has not achieved candidacy by the end of their second year (Spring Term 2) will be reviewed by the MSBS Program Committee for placement on academic probation, regardless of grade point average, and recommendations for progress will be established.

Residence

At least one year of residency at the Medical University of South Carolina is required before receiving the M.S. in Biomedical Sciences degree. A graduate student who has completed all the course requirements for the degree and experiments for their thesis and plans to write the thesis either in absentia or in residence must register and pay tuition for a minimum of one hour each semester (course number 980-*Thesis*) until completion of a successful oral defense and submission of the final approved thesis. The student should also indicate his or her intention to graduate the semester before the last term by filling out the Degree Application Form.

Publication requirement

It should be the goal of every student and mentor to eventually publish the student's work, and include the student on publications to which they have made a significant contribution. However, due to the short duration of the program, there is no publication requirement for completion of the MSBS degree.

Policies regarding transition from the M.S. to the Ph.D. program after one year

MSBS students ultimately wishing to pursue a Ph.D. in Biomedical Sciences may apply to the MUSC Ph.D. program in the fall of their first MSBS year, to transition to the Ph.D. program starting in the fall of their second year. Applications should be submitted by January 1st through the College of Graduate Studies online application portal. In most cases, test scores and transcripts submitted for the MSBS application can be moved to the Ph.D. application without charge upon request to Enrollment Management. Admission to the Ph.D. program is in no way guaranteed. Applicants in the MSBS program will be subject to the same expectations and procedures as applicants from outside of MUSC. In general, successful applicants will have performed very well in their fall graduate coursework at MUSC, have an undergraduate GPA and GRE score competitive with the rest of the Ph.D. applicant pool, and have identified a thesis mentor at MUSC willing to commit to supporting them financially for their Ph.D.

MSBS students who apply to the MUSC Ph.D. in Biomedical Sciences program during their first year and are granted admission for the following fall, *must* remain enrolled for a minimum of 9 credits and pay tuition as full time MSBS students throughout the summer term. They shall register for research credits and any available courses of their choosing. They are excused from further MSBS course requirements and will not receive an M.S. degree.

Modifications to degree requirements:

If degree requirements are modified during the period in which a student is continuously enrolled in the Master of Science in Biomedical Sciences program, the requirements in place at the time of the student's matriculation shall be the ones that apply. However, the student may apply to the MSBS Program Committee to be allowed to follow updated requirements.

Required CGS Forms for M.S.

Current versions for the M.S. are available on the [CGS horseshoe webpage here](https://horseshoe.musc.edu/university/colleges/college-of-graduate-studies/students/forms-and-guidelines/ms-forms-and-information):

<https://horseshoe.musc.edu/university/colleges/college-of-graduate-studies/students/forms-and-guidelines/ms-forms-and-information>

M.S. Form Checklist ** forms are welcome before the final due date*

<i>Form name</i>	<i>When due*</i>	<i>How submitted</i>	<i>Complete?</i>
Rotation Agreement	At start of a rotation(s)	Online via RedCAP	
Appointment of Major Advisor	By end of first fall term	Paper, to CGS Office	
Program of Study	Feb 28 of first year	Paper, to CGS Office	
Individual Development Plan	By end of first spring term	Online via RedCAP	
Selection of Thesis Advisory Committee	By end of first spring term	Paper, to CGS Office	
Evaluation of Student Progress with Specific Aims	By end of first spring term	Paper, to CGS Office	
Admission to Candidacy – M.S.	Oct 1 st , second fall term	Paper, to CGS Office	
Plan of Research	Oct 1 st , second fall term	Paper, to CGS Office	
Evaluation of Student Progress (2 nd)	Oct 1 st , second fall term	Paper, to CGS Office	
Thesis defense rubric – formative feedback	Oct 1 st , second fall term	Paper, <i>to student only</i>	
Degree Application / Graduate forms	Jan 1, after second fall term**	Online, Enrollment Management Website	
Thesis Defense Notification	21 days before defense	Paper, to CGS Office	
Successful Defense	Next business day after thesis defense	Paper, to CGS Office	
Thesis Defense Rubric – summative assessment	Next business day after thesis defense	Paper, to CGS Office	
Signed Thesis Title Page	Last day of last term	Paper, to CGS Office	
Exit interview	Last term	In person, CGS Office	

Appendix

Track	Minimum Required Didactic Coursework (not including Research –course number 970)	Required Didactic Credit Hrs
All Tracks except Public Health Sciences	Required: <u>Fall term 1</u> CGS 765 – Proteins: Dynamic Structure and Functions (3 cr) CGS 766 – Gene: Inheritance and Expression (4 cr) CGS 767 – Cells: Organization and Communication (3 cr) CGS 768 – Techniques & Experimental Design (2 cr) CGS 970 – Research (Lab rotations) (1 cr minimum) <u>Spring term 1</u> CGS 770 - Principles, Practices and Professionalism <u>Summer 1</u> CGS 762 – Writing for the Masters Degree	12 fall 2 spring 1 summer
Biochemistry	Additional coursework: BMB 730 Research and Methods seminar, every semester as a student in the Biochemistry track	3 or 4
Microbiology & Immunology	Additional coursework is optional.	0
Neuroscience	Additional Coursework: NSCS 730 – Fundamentals of Neuroscience, Spring Term 1	8
Pathology	Additional Coursework: PATH 700 – Pathology Seminar Series (1cr) fall/spring	4
Pharmacology	Additional coursework is optional.	0
Regenerative Medicine	Additional coursework is optional.	0