

**Handbook
for the
Master of Science
In the
Biomedical Sciences**

West Virginia University

Health Science Center

Graduate Program Director:

**Lisa Salati, PhD
Assistant Vice President for Graduate Education**

December, 2015

TABLE OF CONTENTS

	Page
I. GOALS AND OBJECTIVES OF THE PROGRAM	3
II. ADMISSION INTO THE M.S. PROGRAM	3
A. Traditional Admissions	3
B. Non-traditional Route for Admission to the M.S. program	4
C. Stipend and Tuition Support	4
III. PROGRAM ACTIVITIES	4
A. Core Coursework	5
B. Research Credits	6
C. Seminars and Journal Club	7
D. Training in Ethics	7
IV. ADVISORY COMMITTEE	7
A. Selection of the Committee	7
B. Schedule for Committee Meetings	7
V. ACADEMIC AND PROFESSIONAL STANDARDS	8
A. Grades	8
B. Student Code of Academic and Professional Integrity	8
C. Evaluation of Student's Progress	10
C.1. GP-CAPS Membership	10
C.2. Student Review and Appeals Policy	10
VI. VACATIONS, SICK LEAVE, AND WORK SCHEDULES	11
VII. COMPLETION OF THE DEGREE	11
A.1. Defense of Thesis (Plan A)	11
A.2. Summary paper and oral exam (Plan B)	12
B. Timetable for completion	12
C. Admission to one of the 7-biomedical Ph.D. programs	12
Signature Sheet	14

I. GOALS AND OBJECTIVES OF THE PROGRAM

The M.S. program in the Biomedical Sciences provides a strong foundation in the basic sciences and training in biomedical research to assist students in achieving their occupational objective. Potential career paths for students with an MS in the Biomedical Sciences are:

1. job placement in industry, pharmaceuticals, biotechnology
2. technician in a research laboratory or core facility
3. teaching, patent law, scientific writing
4. investigating a desire to pursue the Ph.D. degree
5. enhancing academic and research credentials for acceptance into a Ph.D. program

To achieve these objectives, the proposed coursework provides the same core foundation knowledge common to first-year curricula in biomedical Ph.D. programs. The coursework uses the same core courses taken by the Ph.D. students in the Biomedical Sciences at WVU and thus provides the M.S. student with potential for advance standing should they choose to apply to WVU. In addition, the M.S. program provides laboratory training for positions in industry or as a technician or laboratory core employee.

The M.S. in Biomedical Sciences offers 2 routes to completion. The Plan A degree involves the completion of a research thesis and is the most desirable route for the individual who wants to demonstrate research proficiency. A Plan B route is also available and involves more coursework and less bench research. Students in this route write a paper summarizing a body of knowledge and their research experience but this experience would be less extensive than a thesis. This route is more acceptable for students pursuing a non-research career.

In addition to the information contained in this handbook, the student is urged to also consult the current Graduate School Catalog for additional information regarding the requirements of the Graduate Council at West Virginia University.

II. ADMISSION INTO THE M.S. PROGRAM

A. Traditional admissions

Prospective students must have an earned bachelor's degree from an accredited university with an overall GPA of at least 3.0 and completed all recommended prerequisites:

1. Biology or related coursework
2. Chemistry, inorganic and organic
3. Physics
4. Mathematics through calculus

Depending on the intended area of emphasis, students lacking one of these prerequisites can remediate that work through taking the relevant courses concurrently with the M.S. curriculum or during summer session.

Applicants must complete the Hobson's online application and submit the following:

1. official transcripts from all undergraduate and graduate institutions attended,
2. official GRE scores,
3. TOEFL scores, if applicable,
4. personal statement describing the applicant's reasons for pursuing graduate work in science, career goals for which this masters will be used and skills that you feel you already have that make this a good career for you,
5. three letters of recommendation from individuals who can evaluate your academic credentials and potential for a scientific career.

Under certain circumstances, the admissions committee may waive the GPA requirement.

Applicants will be evaluated for acceptance into this program by an Admissions Committee composed of representative from each of the 7 biomedical graduate program. Review of applications will begin on Feb. 1 and proceed until all slots are filled or suitable candidates have been identified. Pre-selected students may be invited for a visit/interview in conjunction with the recruitment visits for Ph.D. candidates.

B. Non-traditional route for admission to the M.S. program

In some circumstances, a student in one of the 7 Ph.D. programs in the Biomedical Sciences may request or be recommended to leave the Ph.D. track and compete the M.S. in Biomedical Science. Approval to do so comes from the Graduate Director for the Ph.D. program the student is leaving and the Director of the M.S. in Biomedical Science. The student must meet the academic standards of the M.S. program. They must also fulfill any unfinished requirements of the M.S. program prior to graduating with this degree. For instance, if the student has not yet defended their dissertation proposal, they will need to write and defend a thesis proposal or complete the requirements for a Plan B M.S. (see below). If the student has completed the dissertation proposal, they must set up a meeting with their advisory committee and present a proposal for the portions of this work that will constitute the thesis.

C. Stipend and tuition support

Stipend support for MS in BMS students is not provided by the office of Research and Graduate Education. Once in a laboratory for their thesis research, the faculty mentor may choose to provide stipend support.

III. PROGRAM ACTIVITIES

At the time of entry, students will complete an individual development plan (IDP). This plan was developed by a team of scientists and is available nationally through the American Association for the Advancement of Science (myidp.sciencecareers.org). The student will review the results of this survey with a faculty advisor and register for the relevant coursework and activities. The IDP is reviewed annually. The degree is designed to be completed in 2 to 3 years.

A. Core Coursework:

The total credits for the degree are 41. Students in plan A take a minimum of 24 credits of coursework (including journal clubs and seminars) and 17 credits of research. Students in plan B take at least 33 credits of coursework and 8 credits of research. All students take the same course courses in the first semester. In depth knowledge in a specialized area is achieved by an elective of the student's and advisor's choice in the second year.

Courses	Code	Plan A Credits	Plan B Credits
First Year:			
Fall Semester			
Foundations for contemporary biomedical research	BMS 793A/B	8	8
Cellular Methods	BMS 706	1	1
Discussions on Scientific Integrity	BMS 700	1	1
Short Lab Experiences (3 – 5 week rotations)	BMS 791A	2	2
Spring Semester			
Molecular Genetics	BMS 715	3	3
Program-specific Elective	*	3	6
Journal Club	%	1	1
Research	BMS 797	2#	1#
Summer			
Scientific Writing	BMS 720	2	2
Research	BMS 797	1	1
Second Year:			
Fall Semester			
Program-specific Elective	*	3	4@
Journal Club	%	1	1
Research	BMS 797	5	4
Spring Semester			
Program-specific Elective	*	0	3
Journal Club	%	1	1
Research	BMS 797	8	5
Summer			
Research	BMS 797	3	3

- Elective courses should compliment the student's choice of project and area of interest. This selection is made with the advice of the student's advisor.
- %Students enroll in a journal club consistent with the topics of the laboratory they have chosen.
- #To be a full time student, total credits for the semester should be at least 9 and for the summer should be at least 3.
- @Plan B students need a total of 9 credits of coursework (courses and journal club) during the second year to reach the required 33 credits. If a 4 credit course is not taken, the student will need to take an additional course.

B. Research:

The Masters in Biomedical Science requires the student to plan and conduct research to test a novel hypothesis or question. This research will be reported in a written thesis and defended (Plan A) or a summary paper (Plan B) followed by an oral exam. Note that the number of credits does not necessarily reflect the amount of time to be spent conducting research. The degree is conferred based on completion of the project and not time in the degree program. Thus, students are advised to use their time in the laboratory wisely and efficiently.

Research Plan A: In the Fall semester of Year 2, the student will meet with their graduate advisory committee (see section V) to describe and defend the proposed topic for their research. In preparation for this the student will prepare a document outlining the aims of the project and the planned approach. The format for this document is as follows:

1. Aims of the project – 1 page or less; describe in brief the hypothesis or question to be addressed. This is similar to the aims page of a dissertation proposal for the Ph.D. degree or for a grant application.
2. Background information – 3 pages; here, the student will provide sufficient information for the committee to understand the rationale for the hypothesis or question and any other background information that would be needed to understand the approach.
3. Experimental approach – 3 pages; this sections describes the experiments that you will perform in order to answer the question or test the hypothesis. Sufficient detail should be provided to convince the committee that you know what you plan to do and how to do it. With each approach, include the rationale for using it, the expected results and any anticipated problems.
4. References
5. Attach your biosketch in NIH format.
6. The document should be single-spaced, using Arial font, size 11 or 12 and the margins must be greater than ½ inch.

This document should be given to the members of your committee two weeks prior to the meeting. At the meeting you should prepare a talk with slides in which you describe the project including the background information that drove your hypothesis. Failure to defend the M.S. research proposal by June 30 of the second year in graduate school will result in dismissal from the program.

Research Plan B: Students in the Plan B track still complete a research project(s) but it will not have the breadth of a thesis. In the fall semester of the their second year, the student should meet with their advisory committee and discuss the scope of the project that will be completed. The student should prepare a 2-3 page document that indicates the questions to be addressed, the skills to be learned, and any how this fits in with their long term career goal. This document should be given to the committee members, one week before the scheduled meeting. If a student has been in the thesis or PhD track and is changing to the Plan B MS track, this meeting will more likely reflect a discussion of work accomplished to take and plans for the remaining time in the degree.

C. Seminars and Journal Club

Seminars and journal clubs are the easiest way to stay abreast of the latest research. In this M.S. program they will also provide an opportunity to build critical thinking skills. Students will attend the seminars and journal clubs that are associated with their thesis laboratory and/or their area of research. They will follow the requirements of that journal club and be graded based on their standards.

D. Training in ethics:

All students will be required to complete the online course in scientific ethics developed by CITI and available on the website for the WVU Office of Research Integrity. In addition, they will take the Course in Scientific Ethics offered in the first semester of year 1. Ethics training continues through routine interaction with the faculty advisor.

IV. Advisory committee

A. Selection of the committee

The advisory committee has no fewer than 3 members; the majority of which have full graduate faculty status. It is recommended that one member reflect a discipline distinct from the research to ensure that the student can present their work to a broader audience. The chair of the committee is the research advisor unless they do not have full graduate faculty status; in this case, the advisor and student can ask another committee member to serve in this role. If a student was previously enrolled in the Ph.D. program and had an existing committee with 5 members, they may retain this committee or they may drop one member. The member that is being dropped must consent to their removal. Note that there are forms both for establishing the membership of the committee and for making changes to the committee membership.

B. Schedule for Committee Meetings

The suggested schedule and activity for committee meeting is as follows:

1. Late Spring of first year – approval of the plan of study, review goals for MS and basic plans for research or project (both plan A and plan B)
2. Fall semester of year 2 (plan A) – defense of thesis proposal. This meeting starts with a seminar style presentation of the project background and the student plans followed by a defense style question and answer period.
3. Spring semester of year 2 (plan A and B)- progress on thesis (plan A) or research activity (plan B). The student should provide an update on their plans for completing their work and graduation.
4. Summer of year 2 (plan A and Plan B) – defense of thesis or presentation of review paper and oral exam.
5. Students who are not ready to defend at the end of year 2 should have committee meeting in both the fall and spring of the third year to provide updates on their progress.

Each committee meeting should be documented by the evaluation form or method used by the graduate program with which the research advisor is affiliated and most comfortable. A minimum of 2 meetings is required for graduation.

V. ACADEMIC AND PROFESSIONAL STANDARDS

A. Grades

It is expected that students will perform satisfactorily on all required courses. To remain in good standing in the program a student is required to maintain the following standards:

- a. An overall grade point average of 3.0 in graduate level coursework.
- b. Removal of any incomplete grades within one semester or summer session of their award.
- c. BMS 797 Research is graded S/U. The student should discuss the requirements for an S with their research advisor. An S does not mean the absence of concerns. Written comments originating from either research advisor accompanying the grade will be part of the student's file and will be considered part of the annual evaluation of the student's overall performance. A U in BMS 797 will result in the student being placed on probation. A second U will result in dismissal from the program.
- d. Satisfactory reports of meetings with the Student's advisory committee. Each meeting will be documented with an evaluation procedure used by the Graduate Program with which the thesis advisor is affiliated. These reports will be given to the office of research and graduate studies by the student for placement in the student's file. At least 2 meetings are required for graduation.

Failure to comply with these standards will result in the student being placed on academic probation and may result in dismissal from the graduate program.

B. Student Code of Academic and Professional Integrity

Graduate students in the the MS in Biomedical Sciences are expected to adhere to the following standards of behavior throughout their tenure in graduate school. This code governs student behavior in classrooms, research endeavors, academic and professional gatherings and travel, and in their daily conduct outside of the University. In addition to the code outlined below, all students will uphold the WVU Student Conduct and Discipline Policy. This code can be found at: http://campuslife.wvu.edu/office_of_student_conduct

1. Academic Integrity

Students will:

- not plagiarize the work of others either by directly copying that work or by summarizing the thoughts of others as their own;

- not cheat on any examinations, on academic assignments and activities, and will not provide unauthorized help to others during an examination or graded academic assignment;
- not alter examination scores, answer sheets, other graded materials, or their academic record;
- adhere to the University policies on academic integrity
(<http://catalog.wvu.edu/graduate/enrollmentandregistration/#academicdishonestytext>)

2. Scientific Integrity

Students will:

- have actually carried out experiments as reported;
- represent their best understanding of their work in their descriptions and analyses of it;
- accurately describe methods used in experiments;
- not report the work of others as if it were their own;
- in their publications adequately summarize previous relevant work;
- when acting as reviewers will treat submitted manuscripts and grant applications confidentially and avoid inappropriate use; and
- disclose financial and other interests that might present a conflict-of-interest in their various activities such as reporting research results, serving as reviewers, and mentoring students;
- adhere to the University Research Integrity Procedures that can be viewed at:
<http://www.wvu.edu/~lawfac/mmcidiarmid/aic/Final%20RIC%20Policy%20WVU%205-9-11.pdf>

3. Scientific citizenship

Students will:

- strive to provide timely, efficient and high-quality work;
- function as an effective and respectful team member in the performance of collaborative research;
- strive to always acknowledge the contributions of their co-workers;
- strive to keep all work areas clean, organized, and conducive to high-quality research;
- respect shared work areas and reagents and insure that steps are taken to replenish reagents when they are in low supply;
- refrain from activities that might be disruptive to the work of others, including playing music, conversation, telephone calls
- be attentive in presentations by their colleagues and provide constructive criticism as appropriate;
- seek and accept criticism without reprisal or defensiveness;
- strive to address and remedy situations as they arise and to follow through on all promises and commitments to co-workers;
- wear appropriate clothing in the laboratory and other research settings that is consistent with federal, state, and University regulations;

- speak-up and report any practice, condition, or situation, that may cause harm or that is against federal, state, and University regulations;
- when traveling as a representative of the University and laboratory, the student will behave in a professional manner, uphold the rules of the laboratory with respect to the sharing of data, report expenses in a truthful manner, and refrain from frivolous use of travel funds for meals or modes of transportation that are unnecessary.

4. Professional interactions

Students will:

- strive to increase their knowledge and expertise in order to maintain qualifications consistent with the highest standards available in their discipline;
- accept and adapt to the continual change inherent in the creation and delivery of knowledge;
- be appropriate in dress, language and demeanor at all time and avoid language and dress that is offensive to others;
- respect and protect all students', staff, faculty, study participants', and patient's rights to privacy and confidentiality;
- minimize personal text messaging, e-mailing, telephone calls, and social media while at work;
- respond to all communications in a timely manner;
- listen carefully and to be thoughtful and respectful in all forms of communication and during the attendance of seminars;
- provide training and experience to advance the scientific skills and knowledge of ethical research practices for any trainee under their supervision;
- treat all individuals in a caring, respectful, professional, and empathetic manner.

C. Evaluation of Student's Progress

Student progress is reviewed twice per year by the Graduate Programs Committee on Academic and Professional Standards (GP-CAPS). This committee considers all the information listed above under academics and professionalism.

C.1. GP-CAPS Membership

This committee has representatives from all 7 Biomedical PhD programs and the clinical and translational science graduate programs.

C.2. Student Review and Appeals Policy

Students have the right to due process in all decisions regarding their grades, evaluations, and status in graduate school. Appeals of decisions regarding the above must follow a standard set of procedures. Because the MS in Biomedical Sciences is not departmentally based, the appeals procedure is slightly different than the procedure found in the Graduate Catalog. The procedure for you to use is found on the Research and Graduate education website

(<http://www.hsc.wvu.edu/resoff/graduate-education/policies-and-forms/>). You should familiarize yourself with this policy before you need to use it.

VI. Vacations, Sick Leave, and Work Schedules

Once in the research phase of their graduate work, the student no longer adheres to the vacation schedule of the undergraduate University calendar. If the student is sick for a journal club or seminar, they should inform the faculty member in charge of that activity of their absence. Please note any policies regarding absenteeism in the syllabi of courses. This can be by phone or email and should be done prior to the time of the class or meeting. Do not assume that informing your advisor or a single course director of your absence will result in that absence being communicated to all other faculty. Each faculty member with whom you have a class or other obligation must be informed individually each time an absence is going to happen.

The student should discuss vacation and sick policies with their advisor. The student is cautioned that the degree is granted based on completion of the thesis research and not based on length of time in the program. Thus frequent absences can jeopardize the completion of the degree. As part of the student's professional training, they are advised to adopt habits that promote health, such as proper nutrition, hygiene, regular exercise, and sufficient sleep. The general University guideline for sick leave is 1 day per month. Vacation time varies with appointment; 1 day per month for research staff and 2 for faculty. Most faculty advisors find that they do not use all of the allotted 2 vacations days per month or their sick leave. Graduate students should have a similar expectation. The Health Science Center has a policy for maternity/paternity leave for graduate students, in general this is 6 weeks maternity leave and 2 weeks paternity leave. Many women and men find that they can return to some activity prior to this time. Remember, time spent away from the laboratory either due to illness or vacation will hamper the student's progress on their research. Students who need an extended absence (greater than 1 week) from the program due to illness or personal issues may need to request a formal leave of absence from the program. The Health Science Center Guidelines need to be followed to apply for this.

The student should discuss the expectations for total hours of work as well as the days of service (weekends/holidays) with their dissertation advisor. These expectations are likely to vary between laboratories so it is important to establish what these are upon entry into a laboratory. The student should be aware that these decisions are made in the best interest and safety of the student and for the efficient conduct of the experiments.

VII. COMPLETION OF THE DEGREE

A.1. Defense of the thesis (Plan A)

Demonstration of mastery of their area of emphasis and ability to defend their thesis is the culmination of the degree. Once the thesis research is completed, the student will prepare a written document describing their results. The first chapter should be a literature review of 5 - 8 pages in length. The second chapter should report the results in the form of a manuscript. The

defense of the thesis involves the presentation of a seminar in front of the faculty and students followed by a defense in front of just the student's committee.

A.2. Summary paper and oral exam (Plan B)

Students will summarize the results of the research project that they undertook. The format for this will be more varied than a thesis as the student will not have completed the test of a research question. A suggested format is to begin with a background section that summarizes the relevant literature on the topic followed by a description of the accomplishments beginning with the methodology used, any results obtained and a discussion (suggested length – 8-10 pages). Alternatively, the student and advisor may elect to have the student write a review paper on a topic approved by their committee. The student should present this paper to their committee two weeks prior to the scheduled meeting. The student will present a seminar to the committee summarizing their project or topic and demonstrate their knowledge on this subject by successfully answering questions from the committee. The successful student will demonstrate mastery of the area in which they studied.

Note for both Plan A and Plan B: A first-author publication is not required but a publication of any kind is highly recommended as this documents the student's accomplishments to employers or graduate programs.

B. Timetable for completion (from the University Catalog)

Master's degree students are permitted to continue in a program for a maximum of eight years under their original application. Students who have been inactive for two or more years, or who do not enroll for one year after initial admission, are required to apply for, and be accepted for readmission. The application fee is assessed for reapplication. Graduate work planned with the student's advisory committee (e.g., plan of study) must be satisfactorily completed within a period of eight years immediately preceding the conferring of the degree. A course taken more than eight years previously must be revalidated if it is to be used towards meeting degree requirements. Revalidation can be accomplished by submitting the following information for approval to the Office of Graduate Education and Life:

- A letter from the course instructor listing the criteria used to revalidate the course material
- A copy of the student's performance on the student's revalidation examination
- A letter from the college/school graduate coordinator and/or dean supporting the revalidation

C. Admission to one of the 7-biomedical Ph.D. programs

Upon successful completion of the M.S. degree or during the course of the M.S. curriculum, the student may decide to pursue a Ph.D. If the student has completed the M.S. degree and graduated, then they will need complete the full University admission's application. If the student intends to enter a specific graduate program, the program code should be selected, otherwise the BMS code can be used. Applications to a specific program will be reviewed first by

that program and then by the BMS admission's committee. Successful completion of the M.S. degree does not guarantee admission to the Ph.D. programs.

For student who wish to transfer to a Ph.D. without completing the M.S. degree, they must have completed at least one semester in the M.S. program and they must prepare an application packet (not a formal University application) with a personal statement, CV, transcript, and letter of recommendation from their advisor. The application packet will be reviewed first by the specific program that the student wishes to join and then by the BMS admission's committee. Advance standing may be desired because of the overlap of the curricula for the M.S. and Ph.D. programs and the University policy that only 12 credits can be used toward the new degree.

Signature Page

I have read and understand the Handbook of the Master of Science in the Biomedical Sciences. I agree to abide by the requirements outlined in this document as well as the University requirements governing these degrees.

Signature: _____

Name (printed): _____

Date: _____

I pledge to adhere to the Student Code of Academic and Professional Integrity for the Ph.D. and M.S. degree programs (section B.3) and to maintain the highest standard of scientific integrity in all that I do.

Signature: _____

Name(printed): _____

Date: _____