1. Current Catalog Description

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School of Medicine
Dr. Joseph Shapiro, Dean
http://musom.marshall.edu

BIOMEDICAL RESEARCH, M.S. (Thesis), M.S. (Non-Thesis), Ph.D., M.D./Ph.D.

Areas of Emphasis

- Cardiovascular Disease Cell
- Biology
- Medical Sciences (M.S. only)
- Medical Sciences Research (M.S. only)
- Neurobiology and Addiction
- Obesity and Related Diseases
- Toxicology and Environmental Health

Program Description

The Biomedical Sciences and Clinical and Translational Sciences departments of the Joan C. Edwards School of Medicine offer the following degrees: Doctor of Philosophy (Ph.D.), M.D./Ph.D., and Master of Science (M.S.), both thesis and non-thesis.

The primary goal of the Biomedical Research (BMR) program is to use biomedical and translational research approaches to help reduce the numerous health disparities and improve the health of the population in West Virginia and central Appalachia. To do this, students will take an interdisciplinary approach with defined interests and special in-depth training in one of the following research areas of emphasis: Cardiovascular Disease; Cell Biology; Obesity and Related Diseases; Neurobiology and Addiction; and Toxicology and Environmental Health. These areas are designed to be flexible and research oriented in order to develop the interests, capabilities and potential of all students pursuing careers in academic, government, or industrial biomedical sciences.

In addition, the BMR program offers a non-thesis Master of Science degree with a medical sciences area of emphasis to improve the science foundation of students seeking admission into doctoral programs in medicine or other health-related professions. Admission into the BMR M.S. Medical Sciences program does not guarantee admission into medical school. Additionally, a research component to this emphasis is available, but not required. Students choosing the research component may work up to 19 hours per week while earning a minimum of $10/hour. Students are expected to stay in good academic standing.

Also offered is the combined M.D./Ph.D. Students in this program blend the discovery of new knowledge with clinical medicine at the intersection of science and medicine. M.D./Ph.D. Most graduates work as physicianscientists at medical schools, conducting disease-related research and applying the results to the treatment of patients. They have a unique perspective on both the basic science and clinical science behind disease. Further general information is available at the Association of American Medical Colleges website (aamc.org).

Admission Requirements

Applicants must meet the admission requirements of both Marshall University Graduate Admissions as outlined on their website - *www.marshall.edu/graduate/admissions/how-to-apply-for-admission* - and the Biomedical Research program of the Marshall University Joan C. Edwards School of Medicine. Interested persons should visit *https://jcesom.marshall.edu/research*, e-mail *mubiomed@marshall.edu* and/or call 304-696-3365.

Biomedical Research M.S. (Thesis and Non-Thesis) Applicants

Minimum Admission Requirements

- A baccalaureate degree from a regionally accredited college or university
- Successfully completed, with a grade of C or better, one year of general biology, physics, general chemistry, and organic chemistry, all with associated laboratories. A semester of biochemistry or molecular biology with associated laboratory is also required.
- A recommended minimum Grade Point Average (GPA) of3.0
- A recommended minimum GPA of 3.0 in combined science and math courses
- Graduate Record Examination (GRE) General Test scores - REQUIRED for M.S. THESIS ONLY
- Official transcript from degree granting institution/s and institutions where relevant post-baccalaureate or graduate coursework was taken
- Departmental materials: three recommendations, program online form, written statement addressing educational and career goals, CV/resume

PRIORITY Deadline - June 1 for best chance of admission

Applications are accepted on a rolling basis and are reviewed until the class is filled. Applications will be considered after the priority deadline until June 30, if openings are available. The completed application, application fee, official transcript(s), three recommendations, written statement, and official GRE scores should be received in the Graduate Admissions Office by June 1. *For the Medical Sciences area of emphasis only, no entrance exam is required.* The program online form should be received in the Office of Research and Graduate Education by June 1.

Duration of Degree Program

Students are expected to complete the degree within two years. This includes the summer between years one and two for M.S. (thesis) students.

Entry Term

BMR M.S. (thesis) students may matriculate in July (summer III term) or in August (fall term). BMR M.S. (non-thesis) students with an area of emphasis in Medical Sciences must matriculate in the fall term only.

Ph.D. Applicants

Minimum Admission Requirements

- A baccalaureate degree from a regionally accredited college or university
- Successful completion, with a grade of *C* or better, of one year each of general biology, physics, general chemistry, and organic chemistry, all with associated laboratories. A semester of biochemistry or molecular biology with associated laboratory is also required.
- A recommended minimum Grade Point Average (GPA) of3.0
- A recommended minimum GPA of 3.0 in combined science and math courses
- Graduate Record Examination (GRE) General Test scores
- Official transcript from degree granting institution/s; other transcripts may be required
- Departmental materials: three recommendations, program online form, written statement addressing educational and career goals, CV/resume

PRIORITY Deadline - March 1 for best chance of admission

Applications are accepted on a rolling basis and are reviewed until the class is filled. Applications will be considered after the priority deadline until June 30, if openings are available. International applicants must meet the international application deadline of March 15. The completed application, application fee, official transcript(s), and official GRE scores should be received in the Graduate Admissions Office by March 1. MCAT scores will be considered for admission on a case-by-case basis. For the application to be complete, the program online form, written statement addressing educational and career goals, and three recommendations should be received in the Office of Research and Graduate Education by March 1.

Duration of Degree Program

Doctoral degree students are expected to complete the requirements within five years. Students who possess an M.S. degree in Biomedical Research or the equivalent when admitted into the doctoral degree program generally require three to four years to complete the Doctor of Philosophy degree.

Entry Term

BMR Ph.D. students will matriculate in July (summer III term). The first week will be devoted to orientation and Preparation for Graduate Academics (PGA) Boot Camp. This allows students to learn more about research opportunities, get to know their cohort and current students, acclimate to a new environment, and get a head start on their research rotations.

BIOMEDICAL RESEARCH, M.S. (Thesis - Cardiovascular Disease, Cell Biology; Neurobiology and Addiction; Obesity and Related Diseases; Toxicology and Environmental Health)

Degree Requirements

All students are required to meet the general requirements of the Graduate College for receipt of a master's degree. A minimum of 32 credit hours is required for the thesis degree with no more than six hours of thesis (BMR 681) credited toward the 32 credit hour requirement. Each student will specialize in one of the five areas of emphasis as defined in the program description. If the non-thesis master's degree is pursued, a minimum of 36 credit hours is required. All students are required to successfully complete the following core curriculum:

BMR 601 Introduction to Nucleic Acids and Proteins
BMR 602 Introduction to Cell Structure and Metabolism

(continued)

BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences
BMR	644	Responsible Conduct of Research
BMR	660/661	Communication Skills for Biomedical Sciences
BMR	680	Seminar (minimum of 4 hrs.)
BMR	785	Introduction to Research

In addition, the student must successfully complete other courses required by his/her area of emphasis and advisory committee and pass a written and/or oral comprehensive examination.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

Advisory Committee for M.S. (Thesis) Students

The advisory committee should be formed no later than the end of the first year of graduate education. As soon as the committee has been identified, a Thesis Committee Formation form is completed and submitted to the Director ofGraduate Studies.

The advisory committee will be selected by the student and research advisor, with approval from the Director of Graduate Studies required. The committee will be composed of at least three faculty members with appropriate expertise; one of the members may be from another institution. The student's research advisor will act as the chairperson of the committee.

In addition, after 12 hours of coursework has been completed, the student must submit an M.S. Plan of Study form to the Dean of the Graduate College.

BIOMEDICAL RESEARCH, M.S. (Non-Thesis Medical Sciences Area of Emphasis)

A minimum of 36 credit hours is required for the non-thesis degree. In addition, the student must pass a written comprehensive examination covering BMR 601-604 and BMR 882, or have a research . All students are required to successfully complete the following core curriculum:

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences (or MTH 518, BSC 517, PSY 517, EDF 517 or equivalent)
BMR	680	Seminar (minimum of 4 hrs.)
BMR	785	Introduction to Research
MCB	631	Medical Microbiology I
MCB	632	Medical Microbiology II
PHS	628	Neurophysiology

Elective classes include PHS 629 (Mammalian Physiology), PMC 621 (Medical Pharmacology I). and PMC 622 (Medical Pharmacology II).

In addition, after 12 hours of coursework has been completed, the student must submit to an M.S. Plan of Study form to the Dean of the Graduate College.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

BIOMEDICAL RESEARCH, M.S. (Non-Thesis Medical Sciences Research Area of Emphasis)

A minimum of 36 credit hours is required for the non-thesis degree. In addition, the student must pass a written comprehensive examination covering BMR 601-604 and BMR 882, or have a research . All students are required to successfully complete the following core curriculum:

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences (or STA 518, BSC 517, PSY 517, EDF 517 or equivalent)

(continued)

BMR	680	Seminar (minimum of 4 hrs.)
BMR	785	Introduction to Research
BMR	882	Research (minimum of 12 hours)

Recommended elective classes are CTS 614 (Online Survey Tools, Relational and Data Warehousing, and Data Manipulation), PHS 629 (Mammalian Physiology}, MCB 631(Medical Microbiology I), and MCB 632 (Medical Microbiology II}.

In addition, after 12 hours of coursework has been completed, the student must submit an M.S. Plan of Study form to the Dean of the Graduate College.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

Qualifying for Admission into Marshall University Joan C. Edwards School of Medicine without the MCAT (Pathway Program)

Requirements

- Have a minimum 3.4 GPA in the BMR, M.S. Medical Sciences program at the time of the Marshall University Joan C. Edwards School of Medicine (MUJCESOM) interview
- Graduate from the program with a minimum of a 3.4 GPA
- Pass the M.S. comprehensive exam on the first attempt in May of the program's second year

Benefits

- An MCAT score will not be required for admittance to MUJCESOM
- For interview purposes, out-of-state applicants will be considered the same as in-state students, regardless of residency. Marshall University JCESOM tuition cost will be based on residency status.
- With satisfactory standing, students will receive the mandatory program letter of support.

BIOMEDICAL RESEARCH, M.S., AND SCHOOL OF PHARMACY, PHARM.D.

Students can receive both an M.S. degree from the Biomedical Research Program and a Pharm.D. degree from the School of Pharmacy. Prospective students must apply to and meet the admission requirements for both programs. The curriculum takes five years to complete. In the first year, students take BMR courses; in years 2-5 students take School of Pharmacy courses. All students are required to successfully complete:

Year 1 Fall

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	680	Seminar
PHS	628	Neurophysiology

Year 1 Spring

BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	680	Seminar
BMR	785	Introduction to Research
PHS	629	Mammalian Physiology

Year 2 Fall

PHAR	511	Clinical Immunology
PHAR	531	Biopharmaceutics I
PHAR	541	Pharmacy Practice I
PHAR	542	Immunology and Microbiology
PHAR	551	Biomedical Chemistry
PHAR	811	Introductory Pharmacy Practice Experiences in Community Settings I

Year 2 Spring

PHAR	521	Integrated Laboratory I
PHAR	532	Biopharmaceutics II.
PHAR	543	Pharmacy Practice II
PHAR	544	Principles of Disease and Drug Action

(continued)

PHAR	545	Therapeutics I
PHAR	812	Introductory Pharmacy Practice Experiences in Institutional Settings I

Year 3 Fall

PHAR	611	Integrated Laboratory II
PHAR	621	Pharmacy Law and Ethics
PHAR	622	Drug Information and Communication Skills
PHAR	631	Pharmacometrics
PHAR	632	Pharmacy Practice Management I: Leadership
PHAR	661	Therapeutics II
PHAR	813	Introductory Pharmacy Practice Experiences in Community Settings II

Year 3 Spring

PHAR	612	Therapeutic Drug Dosing
PHAR	633	Patient Care Skills Lab
PHAR	634	Pharmacy Practice Management II: Finance
PHAR	635	Bridging Research Outcomes and Patient Care
PHAR	671	Therapeutics III
PHAR	814	Introductory Pharmacy Practice Experiences in Institutional Settings II

Year 4 Fall

PHAR	711	Medication Therapy Management
PHAR	722	Pharmacy Practice Management III: Patient Safety
PHAR	741	Therapeutics V
PHAR	751	Therapeutics IV
PHAR	815	Ambulatory Care Skills
PHAR	816	Inpatient Practice Skills
		Elective I

Year 4 Spring

PHAR	721	Therapeutics VII: Special Populations
PHAR	731	Case Studies in Pharmacy Practice
PHAR	761	Therapeutics VI: Heamatology, Oncology, Nutrition, Hepatic and Musculoskeletal Disorders
PHAR	817	Introductory Pharmacy Practice Experiences in Practice Management
PHAR	818	Introductory Pharmacy Practice Experiences in Education
		Elective 2

Year 5 Fall and Spring

PHAR	881	Advanced Pharmacy Practice Experiences in General Medicine
PHAR	882	Advanced Pharmacy Practice Experiences in Ambulatory Care/Primary Care
PHAR	883	Advanced Pharmacy Practice Experiences in Community Pharmacy
PHAR	884	Advanced Pharmacy Practice Experiences in Institutional Settings
PHAR	885	Advanced Pharmacy Practice Experiences in Geriatrics
PHAR	886	Advanced Pharmacy Practice Experiences in Diverse Populations
		Elective 3
		Elective 4
		Capstone 1
		Capstone 2

PHAR 635 substitutes for BMR 617, Statistical Techniques for Biomedical Sciences, a BMR requirement.
PHAR 542 substitutes for MCB 631, Medical Microbiology I.
PHAR 531 and PHAR 551 substitute for PMC 625, Drug Metabolism, and PMC 630, Chemical Aspects of Pharmacology.
PHAR 545 and PHAR 671 substitute for BMR 680, Seminar. This will meet the 4 hr. minimum requirement for seminar for the M.S. degree.

A minimum of 36 credit hours is required for a non-thesis degree in the BMR program.

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BMR	601	3 hrs.
BMR	602	3 hrs.
BMR	680	1 hr.
PHS	628	2 hrs.
BMR	603	2 hrs.
BMR	604	1 hr.
BMR	680	1 hr.
BMR	785	3 hrs.
PHS	629	6 hrs.
PHAR	531	3 hrs.
PHAR	542	4 hrs.
PHAR	545	4 hrs.
PHAR	551	5 hrs.
PHAR	635	3 hrs.
PHAR	671	7 hrs.

In addition, the student must pass a written and/or an oral comprehensive examination to receive the M.S. degree.

BIOMEDICAL RESEARCH, Ph.D.

The doctorate is a research or performance degree and does not depend solely on the accumulation of credit hours. The degree requirements are admission to candidacy, and successful completion and defense of a dissertation. The degree signifies that the holder has the competence to function independently at the highest professional level.

Degree Requirements

To qualify for the Doctor of Philosophy degree, the student must pass (*C* or better or *CR*) the following courses:

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences
BMR	644	Responsible Conduct of Research
BMR	660/661	Communication Skills for Biomedical Sciences
BMR	680	Seminar (minimum of 6 hrs.)
BMR	785	Introduction to Research
BMR	882	Research

In addition, the student must successfully complete other courses required by his/her area of emphasis and advisory committee. All courses will be defined in the student's Ph.D. Course of Study form. The student must also pass a written and oral exam prior to becoming a Ph.D. candidate. These exams are set by the advisory committee and are outlined below under Admission to Candidacy.

Before graduating, students are required to write and publish three peer-reviewed manuscripts, two of which must be as first author.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

BIOMEDICAL RESEARCH, M.D./Ph.D.

The Joan C. Edwards School of Medicine offers a combined M.D./Ph.D. degree in partnership with the Biomedical Sciences Graduate Program at Marshall University. The curriculum takes seven to eight years to complete. Students first take years one and two of medical school. During that time they complete the requirements for BMR 785 (Introduction to Research). After passing the USMLE Step I exam at the end of year two, students begin their Ph.D. coursework and research. This takes three to four years. After completing the Ph.D. requirements, students then complete years three and four of medical school. All of the requirements for both the M.D. and Ph.D. degrees must be met.

The medical student course Elements of Medicine (MDC 710) meets the requirements for BMR 601, 602, 603, and 604. Other medical school courses can meet area of emphasis requirements, as determined by the student's advisory committee and the Graduate Studies Committee.

Biomedical Research M.D./Ph.D. Applications

Applicants interested in pursuing the combined degree should indicate this on their medical school AMCAS application.

The AMCAS application period is from June 1 to November 1, with supplemental material due by December 15.

Applications are accepted on a rolling basis and reviewed November 1 through December 15. Final decisions will be made by January 31. Applications and supplemental material will not be accepted beyond the above deadlines. A separate M.D./ Ph.D. admissions subcommittee will review the applications.

Consistent with JCESOM MD program admissions policy, all applicants are required to take the MCAT. An MCAT score of 498 or better is preferred. Provided they meet the requirements for not taking the MCAT, students from the JCESOM Medical Sciences Pathway Program who have fulfilled both the criteria for admittance to the MU JCESOM M.D. program and who have extensive research experience (e.g., co-authorship in multiple publications in peer reviewed journals) will be considered for interviews.

Advisory Committee for Ph.D. Students

The advisory committee should be formed no later than the end of the first year of graduate education or upon completion of 18 semester hours of credit. As soon as the committee has been identified, an Approval for Dissertation Topic and Committee Membership form is completed and submitted to the Director of Graduate Studies and the Dean of the Graduate College.

The advisory committee will be selected by the student and research advisor, with approval from the Director of Graduate Studies and the Dean of the Graduate College required. The committee will be composed of at least five faculty members with appropriate expertise; one of the members may be from another institution. The student's research advisor will act as the chairperson of the committee.

Approval of Course of Study

It is essential for the student and advisory committee to carefully define a Course of Study by the end of the first year. This is considered a basic contract between the student and the program and includes:

1. Proposed dissertation topic;
2. All transfer credits;
2. Required and elective courses to be taken at Marshall University.; and
3. All competencies to be achieved by the student during graduate study.

These details must be recorded on the Ph.D. Course of Study form and submitted for approval by the Director of Graduate Studies and the Dean of the Graduate College.

Graduate Assistantships for the Doctor of Philosophy Program

Accepted Ph.D. students receive tuition remission, an annual stipend, and health insurance, which are renewable for up to five years. Students also have access to Marshall University's Student Health Clinic. Students are required to pay some fees each term.

Academic Performance for all BMR Graduate Students

- Maintain a minimum of a 3.0 Grade Point Average (GPA). No more than six hours of C and no grades below C may be applied toward the degree.
- If the GPA falls below 3.0, the student will be placed on academic probation. Following notification of probation, the student will be counseled by his/her advisor. At this time, the deficiency will be identified and a written plan will be prepared for removing it within the next nine semester hours. This plan, co-signed by the student and the advisor, must be approved by the Graduate Studies Committee and Director of Graduate Studies before the student can register for additional coursework.
- If probationary status is not removed within nine semester hours, the Dean of the Graduate College, in consultation with the Vice Dean for Research and Graduate Education and the Graduate Studies Committee, will determine whether the student is retained or dismissed from the program. Retention must be recommended by the advisor and student's advisory committee and endorsed by the Graduate Studies Committee.

Transfer Credit

The student may transfer credits completed at other regionally accredited graduate institutions. Approval of the Graduate Studies Committee and the Dean of the Graduate College is contingent on:

1. the grades earned were *B's* or better;
2. the credits are appropriate to the student's program and acceptable to the advisory committee; and
3. the time limitations were not exceeded.

The number of transfer hours acceptable for the Ph.D. degree will be determined by the student's advisory committee and should not exceed 12 credit hours. Approval must be received from both the Graduate Studies Committee and the Dean of the Graduate College. Transfer credit will not become part of the Marshall University Grade Point Average.

Transfer of credits should be accomplished as early as possible. This should be accomplished when the student submits an approved Course of Study form (Ph.D.) or an approved Plan of Study form (M.S.). Attempts to transfer credits during the last semester may delay graduation. Official transcripts must be on file in the Graduate College office by the date that grades are due in the Marshall University Registrar's Office.

Validation of Outdated Coursework

The advisory committee has the option to require validation, by special examination, of courses that members deem to be outdated.

Time Limitations

Students must meet all requirements for the Doctor of Philosophy degree within seven years from the date of enrollment in the first course to be used in the degree program. The Graduate Dean may grant an extension upon recommendation by the Graduate Studies Committee. Absence due to military obligations, long serious illnesses, or similar circumstances beyond the student's control may be considered valid reasons for an extension. It is the option of the advisory committee to require validation of outdated courses by special examination.

Admission to Candidacy

Admission to graduate study and enrollment in graduate courses does not guarantee acceptance as a candidate for the Doctor of Philosophy degree. This is only accomplished by satisfactorily passing a comprehensive qualifying examination and meeting all other specified requirements. The qualifying examination assesses whether the student has attained sufficient knowledge to undertake independent research. The examination should be completed at the end of the second year of study. The examination consists of written and oral components covering all areas specified in the Course of Study. The examination is prepared, administered and graded by the advisory committee. The written portion includes all coursework and relevant topics determined by the advisory committee. The student will be given 2-3 days to complete the written component of the examination.

Upon passing the written examination, the student must submit a grant proposal on the topic of his/her dissertation research or a related topic approved by the advisory committee. The proposal must be in the style of an National Institutes of Health (NIH) Predoctoral grant proposal. Links to the instructions for the proposal format can be found on the BMR Graduate Program website. The grant proposal must be submitted within two months of completion of the written exam and given to the advisory committee members at least two weeks in advance of the oral defense. The oral examination consists of a defense of the grant proposal and, at the discretion of the advisory committee, may include topics from the written portion of the exam in which the student was deemed to be deficient. Successful completion of the qualifying examination is based on approval of the committee. Only one dissenting vote is permitted on each component. If necessary, a single portion of the examination may be repeated at the discretion of the advisory committee. The student must have the approval of the advisory committee to repeat either the written or oral component of the qualifying examination. The committee assesses the deficiencies and determines the time required for the student to make corrections. A student may take a given component of the qualifying examination no more than three times. Failure to pass this examination on the third attempt will result in dismissalfrom the BMR Ph.D. program. The advisory committee must complete an Admission to Candidacy for Ph.D. form after the student completes the examinations and submit it for approval by the Director of Graduate Studies and the Dean of the Graduate College.

Dissertation

All candidates must successfully complete a biomedical research project and prepare, submit, and defend a dissertation. The dissertation must present the results of the candidate's individual investigation and make a definite contribution to the current state of knowledge. While conducting research and writing a dissertation, the student must register for Research (BMR 882) at the beginning of each semester or summer term for which progress is to be earned. No more than 15 hours of Research may be credited toward the degree.

Candidates are to follow the general guidelines outlined in *Publishing Your Dissertation: How to Prepare Your Manuscript for Publication* and *General Information About Dissertations*. Copies of these documents are on file in the Office of Research and Graduate Education. Candidates must also follow the current Graduate College Guide for Preparation and Submission of Electronic Theses and Dissertations, which can be downloaded from the Graduate College website.

Oral Defense of the Dissertation

The oral defense of the dissertation is held during the semester or summer session in which all other degree requirements have been met. The advisory committee must read and tentatively approve the dissertation before the examination can be scheduled. The committee chairperson will complete an Approval to Schedule Dissertation Defense form

and submit it for approval of the Director of Graduate Studies and the Dean of the Graduate College before the examination can be given. Such notification must occur at least two weeks before the proposed date of the defense. A portion of the defense is an open examination and sufficient time is required for adequate public notice.

The open examination usually takes the form of a one-hour seminar. This is followed by a thorough review of the dissertation by the advisory committee and the candidate. Successful completion of the defense requires the approval of all but one of the members of the advisory committee. The results (pass/fail) must be recorded on a Results of Dissertation Examination form, which is to be reported to the Office of Research and Graduate Education and forwarded to the Graduate College Office within 24 hours. Should the candidate fail the defense, reexamination may not be scheduled without the approval of the advisory committee, the Director of Graduate Studies, and the Dean of the Graduate College.

All advisory committee members are to be present for the defense. If this is not possible, the Dean of the Graduate College, or designee, may permit one substitute for any member of the committee except the chairperson. A request for a substitute must be submitted in writing to, and approved by, the Director of Graduate Studies and the Dean of the Graduate College. The committee chairperson, the student, and both the original member of the committee to be replaced, and the substitute must sign this request. The substitute must have the same, or higher, graduate faculty status as the original member and represent the same academic discipline or area of emphasis.

Acceptance of Dissertation

Acceptance of the dissertation is a requirement for the doctoral degree. An accepted dissertation must bear the original signatures of at least all but one member of the advisory committee. If more than one member cannot approve the dissertation, the doctoral degree cannot be recommended. If the substitute member attends and approves the dissertation defense, he or she signs the dissertation. For complete information on the preparation and submission of electronic theses and dissertations see *www.marshall.edu/graduate/current-students/edt.*

Survey of Earned Doctorates

Students are asked to complete and submit the online Survey of Earned Doctorates. Survey of Earned Doctorate information is used by a number of government agencies to assess the state of doctoral education in the U.S., and also to inform their decisions concerning funding of U.S. graduate institutions. The online survey is available at *https://sed.norc.org.*

Publication

All doctoral dissertations and their abstracts will be microfilmed through ProQuest. This requirement cannot be satisfied by any other publication, but other publication of material in the dissertation is both permitted and encouraged.

Process Summary

1. Inquiry from prospective student to the Biomedical Research Graduate Program or Graduate Admissions Office.
2. Receipt of the following official application materials and required fee by the Graduate Admissions Office: application, GRE scores, and transcript(s). International applicants must meet the application requirements of the Office of International Student Services.
3. Receipt of the program online form, written statement addressing educational and career goals, and three recommendations in the Office of Research and Graduate Education by March 1.
4. The Ph.D. Admissions Committee will review completed applications, then interview the top applicants.
5. The Biomedical Research Graduate Program notifies the Graduate Admissions Office and the applicant of the decision of the Admissions Committee.
6. The accepted student arrives in July for boot camp, starts their first laboratory rotation, and registers for coursework.
7. An advisor is selected by the end of the first year. After the dissertation advisor has been selected, an advisory committee is formed. A Ph.D. Course of Study should be completed by the start of the second year.
8. The student completes requisite coursework and other program requirements.
9. The student takes written and oral qualifying examinations for admission to candidacy to the Ph.D. These examinations should be scheduled within two months of each other.
10. The student continues doctoral research under the guidance of his/her advisory committee. The dissertation phase begins with the approval of a dissertation project by the advisory committee, the Biomedical Research Graduate Program, and the Graduate College Dean.
11. The student applies for graduation at the beginning of his or her last semester, no later than the Graduate College deadline. The diploma fee must be paid by this time.
12. A copy of the preliminary draft of the dissertation is given to each member of the advisory committee no later than two weeks prior to the final defense of the dissertation.

13. The chair of the advisory committee requests approval for the defense from the Biomedical Research Graduate Program and the Graduate College no later than two weeks before the scheduled date of the defense.
14. The time and place of the defense of the dissertation are announced.
15. The student defends the dissertation in an oral defense.
16. The student follows the steps to prepare and submit the electronic thesis or dissertation at *www.marshall.edu/graduate/current-students/edt*.

2. Edits to Current Description

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School of Medicine
Dr. Joseph Shapiro, Dean
http://musom.marshall.edu

BIOMEDICAL RESEARCH, M.S. (Thesis), M.S. (Non-Thesis), Ph.D., M.D./Ph.D.

Areas of Emphasis

- Cardiovascular Disease Cell Biology
- Medical Sciences (M.S. only)
- Medical Sciences Research (M.S. only)
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The Biomedical Sciences and Clinical and Translational Sciences departments of the Joan C. Edwards School of Medicine offer the following degrees: Doctor of Philosophy (Ph.D.), M.D./Ph.D., and Master of Science (M.S.), both thesis and non-thesis.

The primary goal of the Biomedical Research (BMR) program is to use biomedical and translational research approaches to help reduce the numerous health disparities and improve the health of the population in West Virginia and central Appalachia. To do this, students will take an interdisciplinary approach with defined interests and special in-depth training in one of the following research areas of emphasis: Cardiovascular Disease; Cell Biology; Obesity and Related Diseases; Neurobiology and Addiction; and Toxicology and Environmental Health. These areas are designed to be flexible and research oriented in order to develop the interests, capabilities and potential of all students pursuing careers in academic, government, or industrial biomedical sciences.

In addition, the BMR program offers a non-thesis Master of Science degree with a medical sciences area of emphasis to improve the science foundation of students seeking admission into doctoral programs in medicine or other health-related professions. Admission into the BMR M.S. Medical Sciences program does not guarantee admission into medical school. Additionally, a research component to this area of emphasis is available, but is not required. Students choosing the research component may work up to 19 hours per week while earning a minimum of $10/hour. Students are expected to stay in good academic standing.

Also offered is the combined M.D./Ph.D. Students in this program blend the discovery of new knowledge with clinical medicine at the intersection of science and medicine. M.D./Ph.D. Most graduates work as physician scientists at medical schools, conducting disease-related research and applying the results to the treatment of patients. They have a unique perspective on both the basic science and clinical science behind disease. Further general information is available at the Association of American Medical Colleges website (aamc.org).

Admission Requirements

Applicants must meet the admission requirements of both Marshall University Graduate Admissions as outlined on their website - *www.marshall.edu/graduate/admissions/how-to-apply-for-admission* - and the Biomedical Research program of the Marshall University Joan C. Edwards School of Medicine. Interested persons should visit *https://jcesom.marshall.edu/research*, e-mail *mubiomed@marshall.edu* and/or call 304-696-3365.

Biomedical Research M.S. (Thesis and Non-Thesis) Applicants

Minimum Admission Requirements

- A baccalaureate degree from a regionally accredited college or university
- Successfully completed, with a grade of C or better, one year of general biology, physics, general chemistry, and organic chemistry, all with associated laboratories. A semester of biochemistry or molecular biology with associated laboratory is also required.
- A recommended minimum Grade Point Average (GPA) of3.0
- A recommended minimum GPA of 3.0 in combined science and math courses
- Graduate Record Examination (GRE) General Test scores - REQUIRED for M.S. THESIS ONLY
- Official transcript from degree granting institution/s and institutions where relevant post-baccalaureate or graduate coursework was taken
- Departmental materials: three recommendations, program online form, written statement addressing educational and career goals, CV/resume

PRIORITY Deadline - June 1 for best chance of admission

Applications are accepted on a rolling basis and are reviewed until the class is filled. Applications will be considered after the priority deadline until June 30, if openings are available. The completed application, application fee, official transcript(s), three recommendations, written statement, and official GRE scores should be received in the Graduate Admissions Office by June 1. *For the Medical Sciences area of emphasis only, no entrance exam is required.* The program online form should be received in the Office of Research and Graduate Education by June 1.

Duration of Degree Program

Students are expected to complete the degree within two years. This includes the summer between years one and two for M.S. (thesis) students.

Entry Term

BMR M.S. (thesis) students may matriculate in July (summer III term) or in August (fall term). BMR M.S. (non-thesis) students with an area of emphasis in Medical Sciences must matriculate in the fall term only.

Biomedical Research M.S. Medical Sciences Area of Emphasis Applicants

Admission Requirements

Applicants must meet the admission requirements of both Marshall University Graduate Admissions as outlined on their website – *www.marshall.edu/graduate/admissions/how-to-apply-for-admission* - and the Medical Sciences program of the Marshall University Joan C. Edwards School of Medicine. Interested persons should visit *https://jcesom.marshall.edu/students/ms-in-biomedical-research-with-medical-science-emphasis/*, e-mail *medicalsciences@marshall.edu* or call 304-696-3531.

Minimum Admission Requirements

- A baccalaureate degree from an accepted, regionally accredited college or university
- Successfully completed, with a grade of C or better, one year of general biology, physics, general chemistry, and organic chemistry, all with associated laboratories. A semester of biochemistry or molecular biology with associated laboratory is also required.
- A recommended minimum Grade Point Average (GPA) of 3.0
- A recommended minimum GPA of 3.0 in combined science and math courses
- Official transcript(s) from undergraduate degree granting institution(s). Transcripts for post-baccalaureate or graduate coursework may be required at the discretion of the program.
- ~~Departmental~~ Program materials: three recommendations, program online form, written statement addressing educational and career goals, CV/resume

Conditional Admission

The Medical Sciences program may admit applicants conditionally, for one term, pending receipt of the final official transcript from the undergraduate degree granting institution.

Application Deadline - June 30

Applications are accepted on a rolling basis and are reviewed until the class is filled. Applications will be considered until June 30, if openings are available. International applicants must meet the international application deadline of March 15. The completed application, application fee, official transcript(s), three recommendations, and written statement should be received in the Graduate Admissions Office by June 30. *No entrance exam is required.* The program online form should be received ~~in the Office of Research and Graduate Education~~ by June 30.

Duration of Degree Program

Students can complete the degree in two years. Students can apply to medical school or other health profession schools in their first year in the program. They are not required to get the degree to matriculate into health profession school.

Entry Term

BMR M.S. students with an area of emphasis in Medical Sciences must matriculate in the fall term only.

Ph.D. Applicants

Minimum Admission Requirements

- A baccalaureate degree from a regionally accredited college or university
- Successful completion, with a grade of *C* or better, of one year each of general biology, physics, general chemistry, and organic chemistry, all with associated laboratories. A semester of biochemistry or molecular biology with associated laboratory is also required.
- A recommended minimum Grade Point Average (GPA) of3.0
- A recommended minimum GPA of 3.0 in combined science and math courses
- Graduate Record Examination (GRE) General Test scores
- Official transcript from degree granting institution/s; other transcripts may be required
- Departmental materials: three recommendations, program online form, written statement addressing educational and career goals, CV/resume

PRIORITY Deadline - March 1 for best chance of admission

Applications are accepted on a rolling basis and are reviewed until the class is filled. Applications will be considered after the priority deadline until June 30, if openings are available. International applicants must meet the international application deadline of March 15. The completed application, application fee, official transcript(s), and official GRE scores should be received in the Graduate Admissions Office by March 1. MCAT scores will be considered for admission on a case-by-case basis. For the application to be complete, the program online form, written statement addressing educational and career goals, and three recommendations should be received in the Office of Research and Graduate Education by March 1.

Duration of Degree Program

Doctoral degree students are expected to complete the requirements within five years. Students who possess an M.S. degree in Biomedical Research or the equivalent when admitted into the doctoral degree program generally require three to four years to complete the Doctor of Philosophy degree.

Entry Term

BMR Ph.D. students will matriculate in July (summer III term). The first week will be devoted to orientation and Preparation for Graduate Academics (PGA) Boot Camp. This allows students to learn more about research opportunities, get to know their cohort and current students, acclimate to a new environment, and get a head start on their research rotations.

BIOMEDICAL RESEARCH, M.S. (Thesis - Cardiovascular Disease, Cell Biology; Neurobiology and Addiction; Obesity and Related Diseases; Toxicology and Environmental Health)

Degree Requirements

All students are required to meet the general requirements of the Graduate College for receipt of a master's degree. A minimum of 32 credit hours is required for the thesis degree with no more than six hours of thesis (BMR 681) credited toward the 32 credit hour requirement. Each student will specialize in one of the five areas of emphasis as defined in the program description. If the non-thesis master's degree is pursued, a minimum of 36 credit hours is required. All students are required to successfully complete the following core curriculum:

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences
BMR	644	Responsible Conduct of Research
BMR	660/661	Communication Skills for Biomedical Sciences
BMR	680	Seminar (minimum of 4 hrs.)
BMR	785	Introduction to Research

In addition, the student must successfully complete other courses required by his/her area of emphasis and advisory committee and pass a written and/or oral comprehensive examination.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

Advisory Committee for M.S. (Thesis) Students

The advisory committee should be formed no later than the end of the first year of graduate education. As soon as the committee has been identified, a Thesis Committee Formation form is completed and submitted to the Director ofGraduate Studies.

The advisory committee will be selected by the student and research advisor, with approval from the Director of Graduate Studies required. The committee will be composed of at least three faculty members with appropriate expertise; one of the members may be from another institution. The student's research advisor will act as the chairperson of the committee.

In addition, after 12 hours of coursework has been completed, the student must submit an M.S. Plan of Study form to the Dean of the Graduate College.

BIOMEDICAL RESEARCH, M.S. (Non-Thesis Medical Sciences Area of Emphasis)

~~A minimum of 36 credit hours is required for the non-thesis degree. In addition, the student must pass a written comprehensive examination covering BMR 601-604 and BMR 882, or have a research . All students are required to successfully complete the following core curriculum:~~

~~BMR~~	~~601~~	~~Introduction to Nucleic Acids and Proteins~~
~~BMR~~	~~602~~	~~Introduction to Cell Structure and Metabolism~~
~~BMR~~	~~603~~	~~Regulation of Cell Function~~
~~BMR~~	~~604~~	~~Cellular Basis of Disease~~
~~BMR~~	~~617~~	~~Statistical Techniques for the Biomedical Sciences (or MTH 518, BSC 517, PSY 517, EDF 517 or equivalent)~~
~~BMR~~	~~680~~	~~Seminar (minimum of 4 hrs.)~~
~~BMR~~	~~785~~	~~Introduction to Research~~
~~MCB~~	~~631~~	~~Medical Microbiology I~~
~~MCB~~	~~632~~	~~Medical Microbiology II~~
~~PHS~~	~~628~~	~~Neurophysiology~~

~~Elective classes include PHS 629 (Mammalian Physiology), PMC 621 (Medical Pharmacology I). and PMC 622 (Medical Pharmacology II).~~

A minimum of 36 credit hours is required for the non-thesis degree. In addition, the student must pass a written comprehensive examination covering their courses. All students are required to successfully complete the following curriculum.

BMR 601	Introduction to Nucleic Acids and Proteins
BMR 602	Introduction to Cell Structure and Metabolism
BMR 603	Regulation of Cell Function
BMR 604	Cellular Basis of Disease
BMR 785	Introduction to Research
BMS 605	Microbiology and Pharmacology for the Medical Sciences
BMS 607	Hematology and Oncology
BMS 612	Gastroenterology and Nutrition
BMS 615	Cardiovascular, Pulmonary, and Renal Systems
BMS 618	Endocrine and Reproductive Systems
BMS 620	Multisystem Disorders
BMS 634	Biostatistics and Epidemiology for the Medical Sciences

Elective classes include BMS 609 (Orthopedics and the Neural Network).

In addition, after 12 hours of coursework has been completed, the student must submit to an M.S. Plan of Study form to the Dean of the Graduate College.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

BIOMEDICAL RESEARCH, M.S. (Non-Thesis Medical Sciences Research Area of Emphasis)

A minimum of 36 credit hours is required for the non-thesis degree. In addition, the student must pass a written comprehensive examination covering BMR 601-604 and BMR 882, or have a research . All students are required to successfully complete the following core curriculum:

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences
		(or STA 518, BSC 517, EDF 517 or equivalent
BMR	680	Seminar (minimum of 4 hrs.)
BMR	785	Introduction to Research
BMR	882	Research (minimum of 12 hours)

Recommended elective classes are CTS 614 (Online Survey Tools, Relational and Data Warehousing, and Data Manipulation), PHS 629 (Mammalian Physiology}, MCB 631(Medical Microbiology I), and MCB 632 (Medical Microbiology II}.

In addition, after 12 hours of coursework has been completed, the student must submit an M.S. Plan of Study form to the Dean of the Graduate College.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

~~Qualifying for Admission into Marshall University Joan C. Edwards School of Medicine without the MCAT (Pathway Program)~~

~~**Requirements**~~

- ~~Have a minimum 3.4 GPA in the BMR, M.S. Medical Sciences program at the time of the Marshall University Joan C. Edwards School of Medicine (MUJCESOM) interview~~
- ~~Graduate from the program with a minimum of a 3.4 GPA~~
- ~~Pass the M.S. comprehensive exam on the first attempt in May of the program's second-year~~

~~**Benefits**~~

- ~~An MCAT score will not be required for admittance to MUJCESOM~~
- ~~For interview purposes, out-of-state applicants will be considered the same as in-state students, regardless of residency. Marshall University JCESOM tuition cost will be based on residency status.~~
- ~~With satisfactory standing, students will receive the mandatory program letter of support.~~

~~BIOMEDICAL RESEARCH, M.S., AND SCHOOL OF PHARMACY, PHARM.D.~~

~~Students can receive both an M.S. degree from the Biomedical Research Program and a Pharm.D. degree from the School of Pharmacy. Prospective students must apply to and meet the admission requirements for both programs. The curriculum takes five years to complete. In the first year, students take BMR courses; in years 2-5 students take School of Pharmacy courses. All students are required to successfully complete:~~

~~**Year 1 Fall**~~

~~BMR~~	~~601~~	~~Introduction to Nucleic Acids and Proteins~~
~~BMR~~	~~602~~	~~Introduction to Cell Structure and Metabolism~~
~~BMR~~	~~680~~	~~Seminar~~
~~PHS~~	~~628~~	~~Neurophysiology~~

~~**Year 1 Spring**~~

~~BMR~~	~~603~~	~~Regulation of Cell Function~~
~~BMR~~	~~604~~	~~Cellular Basis of Disease~~
~~BMR~~	~~680~~	~~Seminar~~
~~BMR~~	~~785~~	~~Introduction to Research~~
~~PHS~~	~~629~~	~~Mammalian Physiology~~

~~**Year 2 Fall**~~

~~PHAR~~	~~511~~	~~Clinical Immunology~~
~~PHAR~~	~~531~~	~~Biopharmaceutics I~~
~~PHAR~~	~~541~~	~~Pharmacy Practice I~~
~~PHAR~~	~~542~~	~~Immunology and Microbiology~~
~~PHAR~~	~~551~~	~~Biomedical Chemistry~~
~~PHAR~~	~~811~~	~~Introductory Pharmacy Practice Experiences in Community Settings I~~

~~**Year 2 Spring**~~

~~PHAR~~	~~521~~	~~Integrated Laboratory I~~
~~PHAR~~	~~532~~	~~Biopharmaceutics II.~~
~~PHAR~~	~~543~~	~~Pharmacy Practice II~~
~~PHAR~~	~~544~~	~~Principles of Disease and Drug Action~~
~~PHAR~~	~~545~~	~~Therapeutics I~~
~~PHAR~~	~~812~~	~~Introductory Pharmacy Experiences in Institutional Settings I~~

~~**Year 3 Fall**~~

~~PHAR~~	~~611~~	~~Integrated Laboratory II~~
~~PHAR~~	~~621~~	~~Pharmacy Law and Ethics~~
~~PHAR~~	~~622~~	~~Drug Information and Communication Skills~~
~~PHAR~~	~~631~~	~~Pharmacometrics~~
~~PHAR~~	~~632~~	~~Pharmacy Practice Management I: Leadership~~
~~PHAR~~	~~661~~	~~Therapeutics II~~
~~PHAR~~	~~813~~	~~Introductory Pharmacy Practice Experiences in Community Settings II~~

~~PHAR~~	~~612~~	~~Therapeutic Drug Dosing~~
~~PHAR~~	~~633~~	~~Patient Care Skills Lab~~
~~PHAR~~	~~634~~	~~Pharmacy Practice Management II: Finance~~
~~PHAR~~	~~635~~	~~Bridging Research Outcomes and Patient Care~~
~~PHAR~~	~~671~~	~~Therapeutics III~~
~~PHAR~~	~~814~~	~~Introductory Pharmacy Practice Experiences in Institutional Settings II~~

~~**Year 4 Fall**~~

~~PHAR~~	~~711~~	~~Medication Therapy Management~~
~~PHAR~~	~~722~~	~~Pharmacy Practice Management III: Patient Safety~~
~~PHAR~~	~~741~~	~~Therapeutics V~~
~~PHAR~~	~~751~~	~~Therapeutics IV~~
~~PHAR~~	~~815~~	~~Ambulatory Care Skills~~
~~PHAR~~	~~816~~	~~Inpatient Practice Skills~~
		~~Elective I~~

~~**Year 4 Spring**~~

~~PHAR 721~~	~~Therapeutics VII: Special Populations~~
~~PHAR 731~~	~~Case Studies in Pharmacy Practice~~
~~PHAR 761~~	~~Therapeutics VI: Heamatology, Oncology, Nutrition, Hepatic and Musculoskeletal Disorders~~
~~PHAR 817~~	~~Introductory Pharmacy Practice Experiences in Practice Management~~
~~PHAR 818~~	~~Introductory Pharmacy Practice Experiences in Education~~
	~~Elective 2~~

~~**Year 5 Fall and Spring**~~

~~PHAR 881~~	~~Advanced Pharmacy Practice Experiences in General Medicine~~
~~PHAR 882~~	~~Advanced Pharmacy Practice Experiences in Ambulatory Care/Primary Care~~
~~PHAR 883~~	~~Advanced Pharmacy Practice Experiences in Community Pharmacy~~
~~PHAR 884~~	~~Advanced Pharmacy Practice Experiences in Institutional Settings~~
~~PHAR 885~~	~~Advanced Pharmacy Practice Experiences in Geriatrics~~
~~PHAR 886~~	~~Advanced Pharmacy Practice Experiences in Diverse Populations~~
	~~Elective 3~~
	~~Elective 4~~
	~~Capstone 1~~
	~~Capstone 2~~

~~PHAR 635 substitutes for BMR 617, Statistical Techniques for Biomedical Sciences, a BMR requirement. PHAR 542 substitutes for MCB 631, Medical Microbiology I.~~
~~PHAR 531 and PHAR 551 substitute for PMC 625, Drug Metabolism, and PMC 630, Chemical Aspects of Pharmacology. PHAR 545 and PHAR 671 substitute for BMR 680, Seminar. This will meet the 4 hr. minimum requirement for seminar for the M.S. degree.~~

~~A minimum of 36 credit hours is required for a non-thesis degree in the BMR program.~~

~~BMR~~	~~601~~	~~3 hrs.~~
~~BMR~~	~~602~~	~~3 hrs.~~
~~BMR~~	~~680~~	~~1 hr.~~
~~PHS~~	~~628~~	~~2 hrs.~~
~~BMR~~	~~603~~	~~2 hrs.~~
~~BMR~~	~~604~~	~~1 hr.~~
~~BMR~~	~~680~~	~~1 hr.~~
~~BMR~~	~~785~~	~~3 hrs.~~
~~PHS~~	~~629~~	~~6 hrs.~~
~~PHAR~~	~~531~~	~~3 hrs.~~
~~PHAR~~	~~542~~	~~4 hrs.~~
~~PHAR~~	~~545~~	~~4 hrs.~~
~~PHAR~~	~~551~~	~~5 hrs.~~
~~PHAR~~	~~635~~	~~3 hrs.~~
~~PHAR~~	~~671~~	~~7 hrs.~~

~~In addition, the student must pass a written and/or an oral comprehensive examination to receive the M.S. degree.~~

BIOMEDICAL RESEARCH, Ph.D.

The doctorate is a research or performance degree and does not depend solely on the accumulation of credit hours. The degree requirements are admission to candidacy, and successful completion and defense of a dissertation. The degree signifies that the holder has the competence to function independently at the highest professional level.

Degree Requirements

To qualify for the Doctor of Philosophy degree, the student must pass (*C* or better or *CR*) the following courses:

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences
BMR	644	Responsible Conduct of Research
BMR	660/661	Communication Skills for Biomedical Sciences
BMR	680	Seminar (minimum of 6 hrs.)
BMR	785	Introduction to Research
BMR	882	Research

In addition, the student must successfully complete other courses required by his/her area of emphasis and advisory committee. All courses will be defined in the student's Ph.D. Course of Study form. The student must also pass a written and oral exam prior to becoming a Ph.D. candidate. These exams are set by the advisory committee and are outlined below under Admission to Candidacy.

Before graduating, students are required to write and publish three peer-reviewed manuscripts, two of which must be as first author.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

BIOMEDICAL RESEARCH, M.D./Ph.D.

The Joan C. Edwards School of Medicine offers a combined M.D./Ph.D. degree in partnership with the Biomedical Sciences Graduate Program at Marshall University. The curriculum takes seven to eight years to complete. Students first take years one and two of medical school. During that time they complete the requirements for BMR 785 (Introduction to Research). After passing the USMLE Step I exam at the end of year two, students begin their Ph.D. coursework and research. This takes three to four years. After completing the Ph.D. requirements, students then complete years three and four of medical school. All of the requirements for both the M.D. and Ph.D. degrees must be met.

The medical student course Elements of Medicine (MDC 710) meets the requirements for BMR 601, 602, 603, and 604. Other medical school courses can meet area of emphasis requirements, as determined by the student's advisory committee and the Graduate Studies Committee.

Biomedical Research M.D./Ph.D. Applications

Applicants interested in pursuing the combined degree should indicate this on their medical school AMCAS application.

The AMCAS application period is from June 1 to November 1, with supplemental material due by December 15.

Applications are accepted on a rolling basis and reviewed November 1 through December 15. Final decisions will be made by January 31. Applications and supplemental material will not be accepted beyond the above deadlines. A separate M.D./ Ph.D. admissions subcommittee will review the applications.

Consistent with JCESOM MD program admissions policy, all applicants are required to take the MCAT. An MCAT score of 498 or better is preferred. Provided they meet the requirements for not taking the MCAT, students from the JCESOM Medical Sciences Pathway Program who have fulfilled both the criteria for admittance to the MU JCESOM M.D. program and who have extensive research experience (e.g., co-authorship in multiple publications in peer reviewed journals) will be considered for interviews.

Advisory Committee for Ph.D. Students

The advisory committee should be formed no later than the end of the first year of graduate education or upon completion of 18 semester hours of credit. As soon as the committee has been identified, an Approval for Dissertation Topic and Committee Membership form is completed and submitted to the Director of Graduate Studies and the Dean of the Graduate College.

The advisory committee will be selected by the student and research advisor, with approval from the Director of Graduate Studies and the Dean of the Graduate College required. The committee will be composed of at least five faculty members with appropriate expertise; one of the members may be from another institution. The student's research advisor will act as the chairperson of the committee.

Approval of Course of Study

It is essential for the student and advisory committee to carefully define a Course of Study by the end of the first year.

This is considered a basic contract between the student and the program and includes:

1. Proposed dissertation topic;
2. All transfer credits;
2. Required and elective courses to be taken at Marshall University.; and
3. All competencies to be achieved by the student during graduate study.

These details must be recorded on the Ph.D. Course of Study form and submitted for approval by the Director of Graduate Studies and the Dean of the Graduate College.

Graduate Assistantships for the Doctor of Philosophy Program

Accepted Ph.D. students receive tuition remission, an annual stipend, and health insurance, which are renewable for up to five years. Students also have access to Marshall University's Student Health Clinic. Students are required to pay some fees each term.

Academic Performance for all BMR Graduate Students

- Maintain a minimum of a 3.0 Grade Point Average (GPA). No more than six hours of C and no grades below C may be applied toward the degree.
- If the GPA falls below 3.0, the student will be placed on academic probation. Following notification of probation, the student will be counseled by his/her advisor. At this time, the deficiency will be identified and a written plan will be prepared for removing it within the next nine semester hours. This plan, co-signed by the student and the advisor, must be approved by the Graduate Studies Committee and Director of Graduate Studies before the student can register for additional coursework.
- If probationary status is not removed within nine semester hours, the Dean of the Graduate College, in consultation with the Vice Dean for Research and Graduate Education and the Graduate Studies Committee, will determine whether the student is retained or dismissed from the program. Retention must be recommended by the advisor and student's advisory committee and endorsed by the Graduate Studies Committee.

Transfer Credit

The student may transfer credits completed at other regionally accredited graduate institutions. Approval of the Graduate Studies Committee and the Dean of the Graduate College is contingent on:

1. the grades earned were *B'*s or better;

2. the credits are appropriate to the student's program and acceptable to the advisory committee; and
3. the time limitations were not exceeded.

The number of transfer hours acceptable for the Ph.D. degree will be determined by the student's advisory committee and should not exceed 12 credit hours. Approval must be received from both the Graduate Studies Committee and the Dean of the Graduate College. Transfer credit will not become part of the Marshall University Grade Point Average.

Transfer of credits should be accomplished as early as possible. This should be accomplished when the student submits an approved Course of Study form (Ph.D.) or an approved Plan of Study form (M.S.). Attempts to transfer credits during the last semester may delay graduation. Official transcripts must be on file in the Graduate College office by the date that grades are due in the Marshall University Registrar's Office.

Validation of Outdated Coursework

The advisory committee has the option to require validation, by special examination, of courses that members deem to be outdated.

Time Limitations

Students must meet all requirements for the Doctor of Philosophy degree within seven years from the date of enrollment in the first course to be used in the degree program. The Graduate Dean may grant an extension upon recommendation by the Graduate Studies Committee. Absence due to military obligations, long serious illnesses, or similar circumstances beyond the student's control may be considered valid reasons for an extension. It is the option of the advisory committee to require validation of outdated courses by special examination.

Admission to Candidacy

Admission to graduate study and enrollment in graduate courses does not guarantee acceptance as a candidate for the Doctor of Philosophy degree. This is only accomplished by satisfactorily passing a comprehensive qualifying examination and meeting all other specified requirements. The qualifying examination assesses whether the student has attained sufficient knowledge to undertake independent research. The examination should be completed at the end of the second year of study. The examination consists of written and oral components covering all areas specified in the Course of Study. The examination is prepared, administered and graded by the advisory committee. The written portion includes all coursework and relevant topics determined by the advisory committee. The student will be given 2-3 days to complete the written component of the examination.

Upon passing the written examination, the student must submit a grant proposal on the topic of his/her dissertation research or a related topic approved by the advisory committee. The proposal must be in the style of ~~an~~ a National Institutes of Health (NIH) Predoctoral grant proposal. Links to the instructions for the proposal format can be found on the BMR Graduate Program website. The grant proposal must be submitted within two months of completion of the written exam and given to the advisory committee members at least two weeks in advance of the oral defense. The oral examination consists of a defense of the grant proposal and, at the discretion of the advisory committee, may include topics from the written portion of the exam in which the student was deemed to be deficient. Successful completion of the qualifying examination is based on approval of the committee. Only one dissenting vote is permitted on each component. If necessary, a single portion of the examination may be repeated at the discretion of the advisory committee. The student must have the approval of the advisory committee to repeat either the written or oral component of the qualifying examination. The committee assesses the deficiencies and determines the time required for the student to make corrections. A student may take a given component of the qualifying examination no more than three times. Failure to pass this examination on the third attempt will result in dismissal from the BMR Ph.D. program. The advisory committee must complete an Admission to Candidacy for Ph.D. form after the student completes the examinations and submit it for approval by the Director of Graduate Studies and the Dean of the Graduate College.

Dissertation

All candidates must successfully complete a biomedical research project and prepare, submit, and defend a dissertation. The dissertation must present the results of the candidate's individual investigation and make a definite contribution to the current state of knowledge. While conducting research and writing a dissertation, the student must register for Research (BMR 882) at the beginning of each semester or summer term for which progress is to be earned. No more than 15 hours of Research may be credited toward the degree.

Candidates are to follow the general guidelines outlined in *Publishing Your Dissertation: How to Prepare Your Manuscript for Publication* and *General Information About Dissertations*. Copies of these documents are on file in the Office of Research and Graduate Education. Candidates must also follow the current Graduate College Guide for Preparation and Submission of Electronic Theses and Dissertations, which can be downloaded from the Graduate College website.

Oral Defense of the Dissertation

The oral defense of the dissertation is held during the semester or summer session in which all other degree requirements have been met. The advisory committee must read and tentatively approve the dissertation before the examination can be scheduled. The committee chairperson will complete an Approval to Schedule Dissertation Defense form and submit it for approval of the Director of Graduate Studies and the Dean of the Graduate College before the examination can be given. Such notification must occur at least two weeks before the proposed date of the defense. A portion of the defense is an open examination and sufficient time is required for adequate public notice.

The open examination usually takes the form of a one-hour seminar. This is followed by a thorough review of the dissertation by the advisory committee and the candidate. Successful completion of the defense requires the approval of all but one of the members of the advisory committee. The results (pass/fail) must be recorded on a Results of Dissertation Examination form, which is to be reported to the Office of Research and Graduate Education and forwarded to the Graduate College Office within 24 hours. Should the candidate fail the defense, reexamination may not be scheduled without the approval of the advisory committee, the Director of Graduate Studies, and the Dean of the Graduate College.

All advisory committee members are to be present for the defense. If this is not possible, the Dean of the Graduate College, or designee, may permit one substitute for any member of the committee except the chairperson. A request for a substitute must be submitted in writing to, and approved by, the Director of Graduate Studies and the Dean of the Graduate College. The committee chairperson, the student, and both the original member of the committee to be replaced, and the substitute must sign this request. The substitute must have the same, or higher, graduate faculty status as the original member and represent the same academic discipline or area of emphasis.

Acceptance of Dissertation

Acceptance of the dissertation is a requirement for the doctoral degree. An accepted dissertation must bear the original signatures of at least all but one member of the advisory committee. If more than one member cannot approve the dissertation, the doctoral degree cannot be recommended. If the substitute member attends and approves the dissertation defense, he or she signs the dissertation. For complete information on the preparation and submission of electronic theses and dissertations see *www.marshall.edu/graduate/current-students/edt.*

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Publication

All doctoral dissertations and their abstracts will be microfilmed through ProQuest. This requirement cannot be satisfied by any other publication, but other publication of material in the dissertation is both permitted and encouraged.

Process Summary

1. Inquiry from prospective student to the Biomedical Research Graduate Program or Graduate Admissions Office.
2. Receipt of the following official application materials and required fee by the Graduate Admissions Office: application, GRE scores, and transcript(s). International applicants must meet the application requirements of the Office of International Student Services.
3. Receipt of the program online form, written statement addressing educational and career goals, and three recommendations in the Office of Research and Graduate Education by March 1.
4. The Ph.D. Admissions Committee will review completed applications, then interview the top applicants.
5. The Biomedical Research Graduate Program notifies the Graduate Admissions Office and the applicant of the decision of the Admissions Committee.
6. The accepted student arrives in July for boot camp, starts their first laboratory rotation, and registers for coursework.
7. An advisor is selected by the end of the first year. After the dissertation advisor has been selected, an advisory committee is formed. A Ph.D. Course of Study should be completed by the start of the second year.
8. The student completes requisite coursework and other program requirements.
9. The student takes written and oral qualifying examinations for admission to candidacy to the Ph.D. These examinations should be scheduled within two months of each other.
10. The student continues doctoral research under the guidance of his/her advisory committee. The dissertation phase begins with the approval of a dissertation project by the advisory committee, the Biomedical Research Graduate Program, and the Graduate College Dean.
11. The student applies for graduation at the beginning of his or her last semester, no later than the Graduate College deadline. The diploma fee must be paid by this time.
12. A copy of the preliminary draft of the dissertation is given to each member of the advisory committee no later than two weeks prior to the final defense of the dissertation.
13. The chair of the advisory committee requests approval for the defense from the Biomedical Research Graduate Program and the Graduate College no later than two weeks before the scheduled date of the defense.
14. The time and place of the defense of the dissertation are announced.
15. The student defends the dissertation in an oral defense.
16. The student follows the steps to prepare and submit the electronic thesis or dissertation at *www.marshall.edu/graduate/current-students/edt*.

3. New Catalog Description

Pages 220-229

School of Medicine
Dr. Joseph Shapiro, Dean
http://musom.marshall.edu

BIOMEDICAL RESEARCH, M.S. (Thesis), M.S. (Non-Thesis), Ph.D., M.D./Ph.D.

Areas of Emphasis

- Cardiovascular Disease Cell Biology
- Medical Sciences (M.S. only)
- Medical Sciences Research (M.S. only)
- Neurobiology and Addiction
- Obesity and Related Diseases
- Toxicology and Environmental Health

Program Description

The Biomedical Sciences and Clinical and Translational Sciences departments of the Joan C. Edwards School of Medicine offer the following degrees: Doctor of Philosophy (Ph.D.), M.D./Ph.D., and Master of Science (M.S.), both thesis and non-thesis.

The primary goal of the Biomedical Research (BMR) program is to use biomedical and translational research approaches to help reduce the numerous health disparities and improve the health of the population in West Virginia and central Appalachia. To do this, students will take an interdisciplinary approach with defined interests and special in-depth training in one of the following research areas of emphasis: Cardiovascular Disease; Cell Biology; Obesity and Related Diseases; Neurobiology and Addiction; and Toxicology and Environmental Health. These areas are designed to be flexible and research oriented in order to develop the interests, capabilities and potential of all students pursuing careers in academic, government, or industrial biomedical sciences.

In addition, the BMR program offers a non-thesis Master of Science degree with a medical sciences area of emphasis to improve the science foundation of students seeking admission into doctoral programs in medicine or other health-related professions. Admission into the BMR M.S. Medical Sciences program does not guarantee admission into medical school. Additionally, a research component to this area of emphasis is available, but is not required. Students choosing the research component may work up to 19 hours per week while earning a minimum of $10/hour. Students are expected to stay in good academic standing.

Also offered is the combined M.D./Ph.D. Students in this program blend the discovery of new knowledge with clinical medicine at the intersection of science and medicine. M.D./Ph.D. Most graduates work as physician scientists at medical schools, conducting disease-related research and applying the results to the treatment of patients. They have a unique perspective on both the basic science and clinical science behind disease. Further general information is available at the Association of American Medical Colleges website (aamc.org).

Admission Requirements

Applicants must meet the admission requirements of both Marshall University Graduate Admissions as outlined on their website - *www.marshall.edu/graduate/admissions/how-to-apply-for-admission* - and the Biomedical Research program of the Marshall University Joan C. Edwards School of Medicine. Interested persons should visit *https://jcesom.marshall.edu/research*, e-mail *mubiomed@marshall.edu* and/or call 304-696-3365.

Biomedical Research M.S. (Thesis and Non-Thesis) Applicants

Minimum Admission Requirements

- A baccalaureate degree from a regionally accredited college or university
- Successfully completed, with a grade of C or better, one year of general biology, physics, general chemistry, and organic chemistry, all with associated laboratories. A semester of biochemistry or molecular biology with associated laboratory is also required.
- A recommended minimum Grade Point Average (GPA) of3.0
- A recommended minimum GPA of 3.0 in combined science and math courses
- Graduate Record Examination (GRE) General Test scores - REQUIRED for M.S. THESIS ONLY
- Official transcript from degree granting institution/s and institutions where relevant post-baccalaureate or graduate coursework was taken
- Departmental materials: three recommendations, program online form, written statement addressing educational and career goals, CV/resume

PRIORITY Deadline - June 1 for best chance of admission

Applications are accepted on a rolling basis and are reviewed until the class is filled. Applications will be considered after the priority deadline until June 30, if openings are available. The completed application, application fee, official transcript(s), three recommendations, written statement, and official GRE scores should be received in the Graduate Admissions Office by June 1. *For the Medical Sciences area of emphasis only, no entrance exam is required.* The program online form should be received in the Office of Research and Graduate Education by June 1.

Duration of Degree Program

Students are expected to complete the degree within two years. This includes the summer between years one and two for M.S. (thesis) students.

Entry Term

BMR M.S. (thesis) students may matriculate in July (summer III term) or in August (fall term). BMR M.S. (non-thesis) students with an area of emphasis in Medical Sciences must matriculate in the fall term only.

Biomedical Research M.S. Medical Sciences Area of Emphasis Applicants

Admission Requirements

Applicants must meet the admission requirements of both Marshall University Graduate Admissions as outlined on their website – *www.marshall.edu/graduate/admissions/how-to-apply-for-admission* - and the Medical Sciences program of the Marshall University Joan C. Edwards School of Medicine. Interested persons should visit *https://jcesom.marshall.edu/students/ms-in-biomedical-research-with-medical-science-emphasis/*, e-mail *medicalsciences@marshall.edu* or call 304-696-3531.

Minimum Admission Requirements

- A baccalaureate degree from an accepted, regionally accredited college or university
- Successfully completed, with a grade of C or better, one year of general biology, physics, general chemistry, and organic chemistry, all with associated laboratories. A semester of biochemistry or molecular biology with associated laboratory is also required.
- A recommended minimum Grade Point Average (GPA) of 3.0
- A recommended minimum GPA of 3.0 in combined science and math courses
- Official transcript(s) from undergraduate degree granting institution(s). Transcripts for post-baccalaureate or graduate coursework may be required at the discretion of the program.
- Program materials: three recommendations, program online form, written statement addressing educational and career goals, CV/resume

Conditional Admission

The Medical Sciences program may admit applicants conditionally, for one term, pending receipt of the final official transcript from the undergraduate degree granting institution.

Application Deadline - June 30

Applications are accepted on a rolling basis and are reviewed until the class is filled. Applications will be considered until June 30, if openings are available. International applicants must meet the international application deadline of March 15. The completed application, application fee, official transcript(s), three recommendations, and written statement should be received in the Graduate Admissions Office by June 30. *No entrance exam is required.* The program online form should be received by June 30.

Duration of Degree Program

Students can complete the degree in two years. Students can apply to medical school or other health profession schools in their first year in the program. They are not required to get the degree to matriculate.

Entry Term

BMR M.S. students with an area of emphasis in Medical Sciences must matriculate in the fall term only.

Ph.D. Applicants

Minimum Admission Requirements

- A baccalaureate degree from a regionally accredited college or university
- Successful completion, with a grade of *C* or better, of one year each of general biology, physics, general chemistry, and organic chemistry, all with associated laboratories. A semester of biochemistry or molecular biology with associated laboratory is also required.
- A recommended minimum Grade Point Average (GPA) of3.0
- A recommended minimum GPA of 3.0 in combined science and math courses
- Graduate Record Examination (GRE) General Test scores
- Official transcript from degree granting institution/s; other transcripts may be required
- Departmental materials: three recommendations, program online form, written statement addressing educational and career goals, CV/resume

PRIORITY Deadline - March 1 for best chance of admission

Applications are accepted on a rolling basis and are reviewed until the class is filled. Applications will be considered after the priority deadline until June 30, if openings are available. International applicants must meet the international application deadline of March 15. The completed application, application fee, official transcript(s), and official GRE scores should be received in the Graduate Admissions Office by March 1. MCAT scores will be considered for admission on a case-by-case basis. For the application to be complete, the program online form, written statement addressing educational and career goals, and three recommendations should be received in the Office of Research and Graduate Education by March 1.

Duration of Degree Program

Doctoral degree students are expected to complete the requirements within five years. Students who possess an M.S. degree in Biomedical Research or the equivalent when admitted into the doctoral degree program generally require three to four years to complete the Doctor of Philosophy degree.

Entry Term

BMR Ph.D. students will matriculate in July (summer III term). The first week will be devoted to orientation and Preparation for Graduate Academics (PGA) Boot Camp. This allows students to learn more about research opportunities, get to know their cohort and current students, acclimate to a new environment, and get a head start on their research rotations.

BIOMEDICAL RESEARCH, M.S. (Thesis - Cardiovascular Disease, Cell Biology; Neurobiology and Addiction; Obesity and Related Diseases; Toxicology and Environmental Health)

Degree Requirements

All students are required to meet the general requirements of the Graduate College for receipt of a master's degree. A minimum of 32 credit hours is required for the thesis degree with no more than six hours of thesis (BMR 681) credited toward the 32 credit hour requirement. Each student will specialize in one of the five areas of emphasis as defined in the program description. If the non-thesis master's degree is pursued, a minimum of 36 credit hours is required. All students are required to successfully complete the following core curriculum:

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences
BMR	644	Responsible Conduct of Research
BMR	660/661	Communication Skills for Biomedical Sciences
BMR	680	Seminar (minimum of 4 hrs.)
BMR	785	Introduction to Research

In addition, the student must successfully complete other courses required by his/her area of emphasis and advisory committee and pass a written and/or oral comprehensive examination.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

Advisory Committee for M.S. (Thesis) Students

The advisory committee should be formed no later than the end of the first year of graduate education. As soon as the committee has been identified, a Thesis Committee Formation form is completed and submitted to the Director ofGraduate Studies.

The advisory committee will be selected by the student and research advisor, with approval from the Director of Graduate Studies required. The committee will be composed of at least three faculty members with appropriate expertise; one of the members may be from another institution. The student's research advisor will act as the chairperson of the committee.

In addition, after 12 hours of coursework has been completed, the student must submit an M.S. Plan of Study form to the Dean of the Graduate College.

BIOMEDICAL RESEARCH, M.S. (Non-Thesis Medical Sciences Area of Emphasis)

A minimum of 36 credit hours is required for the non-thesis degree. In addition, the student must pass a written comprehensive examination covering their courses. All students are required to successfully complete the following curriculum.

BMR 601	Introduction to Nucleic Acids and Proteins
BMR 602	Introduction to Cell Structure and Metabolism
BMR 603	Regulation of Cell Function
BMR 604	Cellular Basis of Disease
BMR 785	Introduction to Research
BMS 605	Microbiology and Pharmacology for the Medical Sciences
BMS 607	Hematology and Oncology
BMS 612	Gastroenterology and Nutrition
BMS 615	Cardiovascular, Pulmonary, and Renal Systems
BMS 618	Endocrine and Reproductive Systems
BMS 620	Multisystem Disorders
BMS 634	Biostatistics and Epidemiology for the Medical Sciences

Elective classes include BMS 609 (Orthopedics and the Neural Network).

In addition, after 12 hours of coursework has been completed, the student must submit to an M.S. Plan of Study form to the Dean of the Graduate College.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

BIOMEDICAL RESEARCH, M.S. (Non-Thesis Medical Sciences Research Area of Emphasis)

A minimum of 36 credit hours is required for the non-thesis degree. In addition, the student must pass a written comprehensive examination covering BMR 601-604 and BMR 882, or have a research . All students are required to successfully complete the following core curriculum:

BMR	601	Introduction to Nucleic Acids and Proteins
BMR	602	Introduction to Cell Structure and Metabolism
BMR	603	Regulation of Cell Function
BMR	604	Cellular Basis of Disease
BMR	617	Statistical Techniques for the Biomedical Sciences
		(or STA 518, BSC 517, EDF 517 or equivalent
BMR	680	Seminar (minimum of 4 hrs.)
BMR	785	Introduction to Research
BMR	882	Research (minimum of 12 hours)

Recommended elective classes are CTS 614 (Online Survey Tools, Relational and Data Warehousing, and Data Manipulation), PHS 629 (Mammalian Physiology}, MCB 631(Medical Microbiology I), and MCB 632 (Medical Microbiology II}.

In addition, after 12 hours of coursework has been completed, the student must submit an M.S. Plan of Study form to the Dean of the Graduate College.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

BIOMEDICAL RESEARCH, Ph.D.

The doctorate is a research or performance degree and does not depend solely on the accumulation of credit hours. The degree requirements are admission to candidacy, and successful completion and defense of a dissertation. The degree signifies that the holder has the competence to function independently at the highest professional level.

Degree Requirements

To qualify for the Doctor of Philosophy degree, the student must pass (*C* or better or *CR*) the following courses:

BMR 601 Introduction to Nucleic Acids and Proteins
BMR 602 Introduction to Cell Structure and Metabolism
BMR 603 Regulation of Cell Function
BMR 604 Cellular Basis of Disease
BMR 617 Statistical Techniques for the Biomedical Sciences
BMR 644 Responsible Conduct of Research
BMR 660/661 Communication Skills for Biomedical Sciences
BMR 680 Seminar (minimum of 6 hrs.)
BMR 785 Introduction to Research
BMR 882 Research

In addition, the student must successfully complete other courses required by his/her area of emphasis and advisory committee. All courses will be defined in the student's Ph.D. Course of Study form. The student must also pass a written and oral exam prior to becoming a Ph.D. candidate. These exams are set by the advisory committee and are outlined below under Admission to Candidacy.

Before graduating, students are required to write and publish three peer-reviewed manuscripts, two of which must be as first author.

To remain in good academic standing and to graduate, the student must have a minimum graduate GPA of 3.0.

BIOMEDICAL RESEARCH, M.D./Ph.D.

The Joan C. Edwards School of Medicine offers a combined M.D./Ph.D. degree in partnership with the Biomedical Sciences Graduate Program at Marshall University. The curriculum takes seven to eight years to complete. Students first take years one and two of medical school. During that time they complete the requirements for BMR 785 (Introduction to Research). After passing the USMLE Step I exam at the end of year two, students begin their Ph.D. coursework and research. This takes three to four years. After completing the Ph.D. requirements, students then complete years three and four of medical school. All of the requirements for both the M.D. and Ph.D. degrees must be met.

The medical student course Elements of Medicine (MDC 710) meets the requirements for BMR 601, 602, 603, and 604. Other medical school courses can meet area of emphasis requirements, as determined by the student's advisory committee and the Graduate Studies Committee.

Biomedical Research M.D./Ph.D. Applications

Applicants interested in pursuing the combined degree should indicate this on their medical school AMCAS application.

The AMCAS application period is from June 1 to November 1, with supplemental material due by December 15.

Applications are accepted on a rolling basis and reviewed November 1 through December 15. Final decisions will be made by January 31. Applications and supplemental material will not be accepted beyond the above deadlines. A separate M.D./ Ph.D. admissions subcommittee will review the applications.

Consistent with JCESOM MD program admissions policy, all applicants are required to take the MCAT. An MCAT score of 498 or better is preferred. Provided they meet the requirements for not taking the MCAT, students from the JCESOM Medical Sciences Pathway Program who have fulfilled both the criteria for admittance to the MU JCESOM M.D. program and who have extensive research experience (e.g., co-authorship in multiple publications in peer reviewed journals) will be considered for interviews.

Advisory Committee for Ph.D. Students

The advisory committee should be formed no later than the end of the first year of graduate education or upon completion of 18 semester hours of credit. As soon as the committee has been identified, an Approval for Dissertation Topic and Committee Membership form is completed and submitted to the Director of Graduate Studies and the Dean of the Graduate College.

The advisory committee will be selected by the student and research advisor, with approval from the Director of Graduate Studies and the Dean of the Graduate College required. The committee will be composed of at least five faculty members with appropriate expertise; one of the members may be from another institution. The student's research advisor will act as the chairperson of the committee.

Approval of Course of Study

It is essential for the student and advisory committee to carefully define a Course of Study by the end of the first year. This is considered a basic contract between the student and the program and includes:

1. Proposed dissertation topic;
2. All transfer credits;
2. Required and elective courses to be taken at Marshall University.; and
3. All competencies to be achieved by the student during graduate study.

These details must be recorded on the Ph.D. Course of Study form and submitted for approval by the Director of Graduate Studies and the Dean of the Graduate College.

Graduate Assistantships for the Doctor of Philosophy Program

Accepted Ph.D. students receive tuition remission, an annual stipend, and health insurance, which are renewable for up to five years. Students also have access to Marshall University's Student Health Clinic. Students are required to pay some fees each term.

Academic Performance for all BMR Graduate Students

- Maintain a minimum of a 3.0 Grade Point Average (GPA). No more than six hours of C and no grades below C may be applied toward the degree.
- If the GPA falls below 3.0, the student will be placed on academic probation. Following notification of probation, the student will be counseled by his/her advisor. At this time, the deficiency will be identified and a written plan will be prepared for removing it within the next nine semester hours. This plan, co-signed by the student and the advisor, must be approved by the Graduate Studies Committee and Director of Graduate Studies before the student can register for additional coursework.
- If probationary status is not removed within nine semester hours, the Dean of the Graduate College, in consultation with the Vice Dean for Research and Graduate Education and the Graduate Studies Committee, will determine whether the student is retained or dismissed from the program. Retention must be recommended by the advisor and student's advisory committee and endorsed by the Graduate Studies Committee.

Transfer Credit

The student may transfer credits completed at other regionally accredited graduate institutions. Approval of the Graduate Studies Committee and the Dean of the Graduate College is contingent on:

1. the grades earned were *B's* or better;
2. the credits are appropriate to the student's program and acceptable to the advisory committee; and
3. the time limitations were not exceeded.

The number of transfer hours acceptable for the Ph.D. degree will be determined by the student's advisory committee and should not exceed 12 credit hours. Approval must be received from both the Graduate Studies Committee and the Dean of the Graduate College. Transfer credit will not become part of the Marshall University Grade Point Average.

Transfer of credits should be accomplished as early as possible. This should be accomplished when the student submits an approved Course of Study form (Ph.D.) or an approved Plan of Study form (M.S.). Attempts to transfer credits during the last semester may delay graduation. Official transcripts must be on file in the Graduate College office by the date that grades are due in the Marshall University Registrar's Office.

Validation of Outdated Coursework

The advisory committee has the option to require validation, by special examination, of courses that members deem to be outdated.

Time Limitations

Students must meet all requirements for the Doctor of Philosophy degree within seven years from the date of enrollment in the first course to be used in the degree program. The Graduate Dean may grant an extension upon recommendation by the Graduate Studies Committee. Absence due to military obligations, long serious illnesses, or similar circumstances beyond the student's control may be considered valid reasons for an extension. It is the option of the advisory committee to require validation of outdated courses by special examination.

Admission to Candidacy

Admission to graduate study and enrollment in graduate courses does not guarantee acceptance as a candidate for the Doctor of Philosophy degree. This is only accomplished by satisfactorily passing a comprehensive qualifying examination and meeting all other specified requirements. The qualifying examination assesses whether the student has attained sufficient knowledge to undertake independent research. The examination should be completed at the end of the second year of study. The examination consists of written and oral components covering all areas specified in the Course of Study. The examination is prepared, administered and graded by the advisory committee. The written portion includes all coursework and relevant topics determined by the advisory committee. The student will be given 2-3 days to complete the written component of the examination.

Upon passing the written examination, the student must submit a grant proposal on the topic of his/her dissertation research or a related topic approved by the advisory committee. The proposal must be in the style of a National Institutes of Health (NIH) Predoctoral grant proposal. Links to the instructions for the proposal format can be found on the BMR Graduate Program website. The grant proposal must be submitted within two months of completion of the written exam and given to the advisory committee members at least two weeks in advance of the oral defense. The oral examination consists of a defense of the grant proposal and, at the discretion of the advisory committee, may include topics from the written portion of the exam in which the student was deemed to be deficient. Successful completion of the qualifying examination is based on approval of the committee. Only one dissenting vote is permitted on each component. If necessary, a single portion of the examination may be repeated at the discretion of the advisory committee. The student must have the approval of the advisory committee to repeat either the written or oral component of the qualifying examination. The committee assesses the deficiencies and determines the time required for the student to make corrections. A student may take a given component of the qualifying examination no more than three times. Failure to pass this examination on the third attempt will result in dismissal from the BMR Ph.D. program. The advisory committee must complete an Admission to Candidacy for Ph.D. form after the student completes the examinations and submit it for approval by the Director of Graduate Studies and the Dean of the Graduate College.

Dissertation

All candidates must successfully complete a biomedical research project and prepare, submit, and defend a dissertation. The dissertation must present the results of the candidate's individual investigation and make a definite contribution to the current state of knowledge. While conducting research and writing a dissertation, the student must register for Research (BMR 882) at the beginning of each semester or summer term for which progress is to be earned. No more than 15 hours of Research may be credited toward the degree.

Candidates are to follow the general guidelines outlined in *Publishing Your Dissertation: How to Prepare Your Manuscript for Publication* and *General Information About Dissertations*. Copies of these documents are on file in the Office of Research and Graduate Education. Candidates must also follow the current Graduate College Guide for Preparation and Submission of Electronic Theses and Dissertations, which can be downloaded from the Graduate College website.

Oral Defense of the Dissertation

The oral defense of the dissertation is held during the semester or summer session in which all other degree requirements have been met. The advisory committee must read and tentatively approve the dissertation before the examination can be scheduled. The committee chairperson will complete an Approval to Schedule Dissertation Defense form

and submit it for approval of the Director of Graduate Studies and the Dean of the Graduate College before the examination can be given. Such notification must occur at least two weeks before the proposed date of the defense. A portion of the defense is an open examination and sufficient time is required for adequate public notice.

The open examination usually takes the form of a one-hour seminar. This is followed by a thorough review of the dissertation by the advisory committee and the candidate. Successful completion of the defense requires the approval of all but one of the members of the advisory committee. The results (pass/fail) must be recorded on a Results of Dissertation Examination form, which is to be reported to the Office of Research and Graduate Education and forwarded to the Graduate College Office within 24 hours. Should the candidate fail the defense, reexamination may not be scheduled without the approval of the advisory committee, the Director of Graduate Studies, and the Dean of the Graduate College.

All advisory committee members are to be present for the defense. If this is not possible, the Dean of the Graduate College, or designee, may permit one substitute for any member of the committee except the chairperson. A request for a substitute must be submitted in writing to, and approved by, the Director of Graduate Studies and the Dean of the Graduate College. The committee chairperson, the student, and both the original member of the committee to be replaced, and the substitute must sign this request. The substitute must have the same, or higher, graduate faculty status as the original member and represent the same academic discipline or area of emphasis.

Acceptance of Dissertation

Acceptance of the dissertation is a requirement for the doctoral degree. An accepted dissertation must bear the original signatures of at least all but one member of the advisory committee. If more than one member cannot approve the dissertation, the doctoral degree cannot be recommended. If the substitute member attends and approves the dissertation defense, he or she signs the dissertation. For complete information on the preparation and submission of electronic theses and dissertations see *www.marshall.edu/graduate/current-students/edt.*

Survey of Earned Doctorates

Students are asked to complete and submit the online Survey of Earned Doctorates. Survey of Earned Doctorate information is used by a number of government agencies to assess the state of doctoral education in the U.S., and also to inform their decisions concerning funding of U.S. graduate institutions. The online survey is available at *https://sed.norc.org.*

Publication

All doctoral dissertations and their abstracts will be microfilmed through ProQuest. This requirement cannot be satisfied by any other publication, but other publication of material in the dissertation is both permitted and encouraged.

Process Summary

1. Inquiry from prospective student to the Biomedical Research Graduate Program or Graduate Admissions Office.
2. Receipt of the following official application materials and required fee by the Graduate Admissions Office: application, GRE scores, and transcript(s). International applicants must meet the application requirements of the Office of International Student Services.
3. Receipt of the program online form, written statement addressing educational and career goals, and three recommendations in the Office of Research and Graduate Education by March 1.
4. The Ph.D. Admissions Committee will review completed applications, then interview the top applicants.
5. The Biomedical Research Graduate Program notifies the Graduate Admissions Office and the applicant of the decision of the Admissions Committee.
6. The accepted student arrives in July for boot camp, starts their first laboratory rotation, and registers for coursework.
7. An advisor is selected by the end of the first year. After the dissertation advisor has been selected, an advisory committee is formed. A Ph.D. Course of Study should be completed by the start of the second year.
8. The student completes requisite coursework and other program requirements.
9. The student takes written and oral qualifying examinations for admission to candidacy to the Ph.D. These examinations should be scheduled within two months of each other.
10. The student continues doctoral research under the guidance of his/her advisory committee. The dissertation phase begins with the approval of a dissertation project by the advisory committee, the Biomedical Research Graduate Program, and the Graduate College Dean.
11. The student applies for graduation at the beginning of his or her last semester, no later than the Graduate College deadline. The diploma fee must be paid by this time.
12. A copy of the preliminary draft of the dissertation is given to each member of the advisory committee no later than two weeks prior to the final defense of the dissertation.

13. The chair of the advisory committee requests approval for the defense from the Biomedical Research Graduate Program and the Graduate College no later than two weeks before the scheduled date of the defense.
14. The time and place of the defense of the dissertation are announced.
15. The student defends the dissertation in an oral defense.
16. The student follows the steps to prepare and submit the electronic thesis or dissertation at *www.marshall.edu/graduate/current-students/edt*.

BIOMEDICAL RESEARCH (BMR)

601 **Introduction to Nucleic Acids and Proteins. 3 hrs.**
A molecular and cell biological study of the structure and function of nucleic acids and proteins. (PR: Consent of instructor)

602 **Introduction to Cell Structure and Metabolism. 3 hrs.**
A molecular and cell biological study of the structure of cells and of cellular metabolism. (CR: BMR 601; PR: Consent of instructor)

603 **Regulation of Cell Function. 2 hrs.**
An advanced molecular and cell biological study of cell metabolism and the regulation of cell function. (PR: BMR 601, BMR 602, and consent of instructor

604 **Cellular Basis of Disease. 1 hr.**
A molecular and cell biological study of the basis of diseases prevalent in Appalachia. (CR: BMR 630; PR: BMR 601, BMR 602, and consent of instructor)

617 **Statistical Techniques for the Biomedical Sciences. 3 hrs.**
An application-oriented course in statistical concepts and techniques aimed at prospective researchers in the biomedical sciences.

628 **Neuroscience I: Major Structures of the Brain, Neuron Function, and Spinal Cord. 3 hrs.**
To study and understand the structure and function of the nervous system and disorders of neuronal function. (PR: BMR 601,602,603,604, or consent of instructor)

629 **Neuroscience II: Structures and Functions of the Brain Stem and Forebrain. 3 hrs.**
To study and understand the structure and function of the nervous system and disorders of neuronal function. (BMR 628 or consent of instructor)

631 **Neuroscience and Developmental Biology Literature Review. 1 hr.**
A seminar course where published articles in the fields of neuroscience and developmental biology will be presented by students and faculty. (PR: Permission of instructor)

632 **Neuroscience Research Techniques. 3 hrs.**
Class participants will be exposed to state-of-the-art neuroscience research techniques while in the laboratories of the neuroscience faculty. (PR: Permission of instructor)

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An in-depth discussion of current literature in developmental biology with emphasis on early embryo development, morphogenesis, lineage determination and regulation of developmental processes. (PR: Permission of instructor)

644 **Responsible Conduct of Research. 1 hr. CR/NC.**
Responsible conduct of research, including human subjects, live vertebrate animals, conflict of interest, mentor/mentee responsibilities, collaborative research, peer review, data management, research misconduct, and responsible authorship, with case discussions.

651 **Cancer Biology. 4 hrs.**
An advanced graduate course on the core principles of initiation, progression, treatment and prevention of cancer, based on current literature. (PR: BMR 601,602,603,604, and permission of instructor)

652 **Cancer Biology Colloquium. 1 hr.**
This is a mentored journal club for graduate students covering selected areas of current interest in cancer biology research. (PR: Permission of instructor)

660 **Communication Skills for Biomedical Sciences I. 1 hr. CR/NC.**
Biomedical graduate students are trained to plan, prepare, and deliver effective scientific presentations.

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664 **Obesity and Related Diseases Journal Club. 1 hr. CR/NC.**
A seminar course where published articles in the field of obesity and obesity-related diseases are presented and discussed.

665 **Cardiovascular Disease Research Colloquium. 1 hr. CR/NC.**
A seminar-style series that will focus on recent advances in topics related to cardiovascular disease.

674 **Teaching Practicum. 1 hr. CR/NC.**
Students gain experience in teaching using a variety of methods in a supervised setting.

676 **CBR Journal Club. 1 hr.**
Mentored journal club preparation with monthly presentation in cellular and molecular biology research.

679 **Special Problems. I, II. CR/NC.**
Intensive study of a selected topic or problem. Emphasizes independent study. (PR: Consent of advisor)

680 **Seminar. 1 hr. I, II. CR/NC.**
Study and discussion of current topics related to the Biomedical Sciences.

681 **Thesis. 1-6 hrs. I, II, S. CR/NC.**

785 **Introduction to Research. 1-6 hrs. I, II, S. CR/NC.**
Directed research activities requiring a completed prospectus for an advanced research project, a written report, or a research thesis. A minimum of three (3) hours required for all M.S. candidates. (PR: Consent of instructor)

882 **Research. 1-15 hrs. I, II, S. CR/NC.**

PHYSIOLOGY (PHS)

628 **Mammalian Neurophysiology. 2 hrs.**
This course is a basic introductory, survey course covering neurophysiology from subcellular level to behavioral level. (PR: Consent of instructor)

629 **Mammalian Physiology. 6 hrs. II.**
A study of mammalian systems including pulmonary, renal, cardiovascular, gastrointestinal, endocrine and reproductive systems. Emphasis will be placed on homeostatic mechanisms and on experimental approaches to physiology. (PR: PHS 628 or PHS 626, PHS 627)

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Class participants will be exposed to state-of-the-art neurophysiology research techniques while in the laboratories of neurophysiology faculty.

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Recently published articles in a selected area of physiological investigation will be presented by participants in the class. Each presentation will be followed by a discussion and evaluation of the paper. (PR: Consent of instructor)

666 **Physiology of the Cell. 3 hrs.**
An in-depth study of selected topics in cell physiology.

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This course introduces students to the fundamental principles and research underlying the normal functioning of the cardiovascular, respiratory, renal, endocrine, reproductive, nervous, and gastrointestinal systems. (PR BMR 601 and BMR 602, or consent of instructor)

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BIOMEDICAL RESEARCH (BMR)

601 **Introduction to Nucleic Acids and Proteins. 3 hrs.**
A molecular and cell biological study of the structure and function of nucleic acids and proteins. (PR: Consent of instructor)

602 **Introduction to Cell Structure and Metabolism. 3 hrs.**
A molecular and cell biological study of the structure of cells and of cellular metabolism. (CR: BMR 601; PR: Consent of instructor)

603 **Regulation of Cell Function. 2 hrs.**
An advanced molecular and cell biological study of cell metabolism and the regulation of cell function. (PR: BMR 601, BMR 602, and consent of instructor

604 **Cellular Basis of Disease. 1 hr.**
A molecular and cell biological study of the basis of diseases prevalent in Appalachia. (CR: BMR 630; PR: BMR 601, BMR 602, and consent of instructor)

617 **Statistical Techniques for the Biomedical Sciences. 3 hrs.**
An application-oriented course in statistical concepts and techniques aimed at prospective researchers in the biomedical sciences.

628 **Neuroscience I: Major Structures of the Brain, Neuron Function, and Spinal Cord. 3 hrs.**
To study and understand the structure and function of the nervous system and disorders of neuronal function. (PR: BMR 601,602,603,604, or consent of instructor)

629 **Neuroscience II: Structures and Functions of the Brain Stem and Forebrain. 3 hrs.**
To study and understand the structure and function of the nervous system and disorders of neuronal function. (BMR 628 or consent of instructor)

631 **Neuroscience and Developmental Biology Literature Review. 1 hr.**
A seminar course where published articles in the fields of neuroscience and developmental biology will be presented by students and faculty. (PR: Permission of instructor)

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This is an integrated introduction to human disease and treatment based on core concepts in microbiology, immunology, and pharmacology, preparing students for detailed studies in subsequent courses.

607 **Hematology and Oncology. 3 hrs.**
This course will help students develop a foundational knowledge of the fundamental concepts of hematology, oncology, and embryology so they can apply these concepts to body systems.

609 **Orthopedics and the Neural Network. 6 hrs.**
This course will enable students to integrate the foundational and clinical concepts important to understand the diseases of the musculoskeletal and nervous systems.

612 **Gastroenterology and Nutrition. 3 hrs.**
This course will use the disciplines of physiology, microbiology, pathology, and pharmacology to help students master the fundamental concepts necessary to understand the normal and diseased gastrointestinal system.

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This course will help students master the foundational concepts and clinical correlations for diseases of three of the five vital organs, i.e., cardiovascular, renal, and the respiratory systems.

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620 **Multisystem Disorders. 2 hrs.**
This course will bring together the concepts taught in earlier courses to address disorders of multiple organ systems.

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