



School of Graduate Studies in the Health Sciences

MICROBIOLOGY CURRICULUM GUIDE

Program Description

The Department of Microbiology offers qualified students the opportunity to earn a PhD in microbiology leading to challenging and rewarding careers in science. The graduate program in microbiology provides students with a foundation in the disciplines of immunology, bacteriology, parasitology, and virology, with intensive training in one of these areas. It emphasizes creative research productivity with a close relationship between faculty and graduate students. In addition to laboratory research under the direction of a faculty mentor, training consists of formal course work (including courses in medical microbiology, immunobiology, bacterial structure and function, medical bacteriology, biochemistry, and virology), seminars and journal clubs. These experiences provides the student with opportunities to develop the skills to critically read the scientific literature, design experiments and solve problems, as well as to speak and write effectively, all of which are critical for success in a scientific career.

Admission Requirements

Prospective students with B.A., B.S., or equivalent degrees will be evaluated based on Graduate Record Examination (GRE) scores, research interests, previous academic performance and their willingness to intensely pursue research as a long-term goal. Applicants for the program should have a high level of intellectual curiosity, an undergraduate grade point average (GPA) of at least 3.0, and a combined (quantitative and verbal) score of 1100 or greater on the Graduate Record Examination (GRE). The department is flexible concerning specific course requirements for admission, although it is expected that undergraduate course work will have been in biological and/or chemical sciences. Qualified applicants will be interviewed by a standing committee of the faculty consisting of the director of the graduate program and representatives of the different research interests within the department who will report their assessments of applicants to the departmental faculty. The faculty then will advise the Chairman of the department by vote on possible admission of an applicant. Based on the faculty vote, the Chairman will decide whether to admit the applicant to the graduate program in the Department of Microbiology. Should an interview with the applicant be impossible, the applicant's records and credentials will be presented to the faculty for consideration.

Program Outcomes

The goals of the **PhD program** in Microbiology are to train highly qualified researchers who will make significant contributions to the fields of Bacteriology, Virology, Parasitology and Immunology and educate those who will teach the next generation of health care professionals and research scientists. The **MS degree** program allows students to acquire academic and research experiences that provide them with skills and knowledge qualifying them for a variety of technical, research, industrial, or teaching positions.

Graduates of the Program in Microbiology will be able to

demonstrate mastery of the fundamental concepts of Microbiology/Immunology and apply these to independently design and perform experiments that extend our knowledge in the field,

critically read and evaluate current literature,

effectively communicate scientific information to a professional audience or in a classroom setting,

manage and prepare successful grant proposals,

produce and publish original research data in respected peer reviewed journals,

successfully find employment or postdoctoral training in an area related to their field of study.

PhD graduates can expect to be employed by pharmaceutical, biochemical, or biotechnology firms, government agencies or continue their academic training as postdoctoral fellows. Many University of Mississippi Microbiology graduates are faculty members at colleges and universities throughout the United States.

CURRICULUM

Core component

MICRO 701 Medical Microbiology (12 hrs)

BIOCH 710 Medical Biochemistry (10 hrs)

MICRO 707 Microbiology Laboratory Rotation (3 hrs)

ID 709 Responsible Conduct of Research (2 hrs)

MICRO 733 Experimental Immunology (3 hrs)

MICRO 702 Viruses (3 hrs)

MICRO 725 Bacterial Structure and Function (3 hrs)

ID710 Research Tools in Molecular Biology (2 hrs)

MICRO 708 Preparation for Instruction in Microbiology (3 hrs)

MICRO 750 Research Proposal (3 hrs)

MICRO 703 Seminar in Microbiology (2 - 3 hrs)

PM 740 Statistical Methods In Research I (3 hrs)

ID 714 Professional Skills for Graduate Students and Postdoctoral Fellows. (3 hrs)

Elective component

- MICRO 735 Viral Biochemistry (2 hrs)
- MICRO 734 Advanced Immunology (2 hrs)
- MICRO 747 Advanced Bacteriology (2 hrs)
- MICRO 715 Special Topics In Microbiology (Credit TBA)
- ID 704 An Introduction To Animal Research (2 hrs)
- ID 715 Teaching In Higher Education (3 hrs)

Dissertation/Thesis

- MICRO 798 Dissertation and dissertation research
- MICRO 799 Thesis and thesis research

Plan of Study

The scheme below represents the basic courses taken by the graduate students in the Department of Microbiology. Note that students entering in an odd year will take the graduate Immunology course (Micro 733) in the spring of their first year, and the graduate Virology (Micro 702) and Bacteriology (Micro 725) courses in the spring of their second year. Students entering in even years take these courses in reverse order. By following this curriculum, students will earn a MS in Biomedical Sciences by May of their second year in Graduate School. Furthermore, they will have completed the bulk of their academic requirements and be eligible to take their qualifying examination during the summer of their second year/fall of their third year.

Suggested Pre-Candidacy Plan of Study

Yr	Semester	Course	Description	Hours
1	Fall	Biochem 710	Medical Biochemistry	10
		Micro 701	Medical Microbiology	6
	Spring	Micro 701	Medical Microbiology	6
		Micro 703	Seminar in Microbiology	1
		ID 710	Research Tools in Molecular Biology	2
		Micro 733	Experimental Immunochemistry and Immunobiology ^a	3
	Summer	Micro 707	Microbiology Laboratory Rotation	3
				Subtotal:

Yr	Semester	Course	Description	Hours	
2	Fall	Micro	708	Preparation for Instruction in Microbiology	3
		PM	740	Statistical Methods In Research I	3
		Micro	704	Research in Microbiology	3
		ID	709	Responsible Conduct of Research	2
	Spring	Micro	703	Seminar in Microbiology	1
		Micro	702	Viruses ^b	3
		Micro	725	Bacterial Structure and Function ^b	3
		Micro	704	Research in Microbiology	3
	Summer	Micro	704	Research in Microbiology	1
	Subtotal:				22

Summer/ Fall	Qualifying Examination	
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Note:

The courses highlighted in yellow represent the core courses for the MS in Biomedical Sciences.

^a The course is offered in odd years.

^b The course is offered in even years.

Post-Candidacy Plan of Study

After the student has passed the qualifying exam and been admitted to candidacy the studies are intensely focused on research. The plan of studies will be tailored to fit the individual student's needs and interests. A PhD candidate needs only to enroll in 1 credit hour/semester (MICRO 798 Dissertation and Dissertation Research). However, in addition to this course, students may enroll in an Advanced Course or Special Topics Course in their area of emphasis (bacteriology, immunology, virology) or in other elective courses offered within the Department of Microbiology or another department. All senior students are also required to take ID714 Professional Skills for Graduate Students and Postdoctoral Fellows during their third or fourth year. By the end of the third year or beginning of the fourth, students are required to take Micro 750 (Research Proposal in Microbiology, 3 credit hours). This course requires the student to write and defend a research proposal before their committee. The time from admission to candidacy (i.e., passing the qualifying examination) to graduation with a PhD degree varies from student to student, but generally requires 2 - 4 years of intense research efforts. A typical registration schedule for a PhD candidate is shown on the next page:

Yr	Semester	Course	Description	Hours
3	Fall	Micro 798 or	Dissertation and Dissertation Research	1
		Micro 7XX	Advanced Elective (optional)	2
	Spring	Micro 798	Dissertation and Dissertation Research	1
		Micro 7XX	Advanced Elective (optional)	2
		ID 714	Professional Skills for Graduate Students and Postdoctoral Fellows.	3
Summer	Micro 750	Research Proposal in Microbiology	3	
4	Fall	Micro 798	Dissertation and Dissertation Research	1
		ID 711	Seminar in Biomedical Science	1
	Spring	Micro 7XX	Advanced Elective (optional)	2
	Summer	Micro 798	Dissertation and Dissertation Research	1
5	Fall	Micro 798	Dissertation and Dissertation Research	1
		ID 711	Seminar in Biomedical Science	1
	Spring	Micro 798	Dissertation and Dissertation Research	1
	Summer	Micro 798	Dissertation and Dissertation Research	1

Note: Micro 7XX refers to any of the advanced courses (Micro 734, 735, 736, 747) and special topics courses (Micro 715).

Mentor selection. During the student's first year of graduate study, scheduled conferences between the student and the faculty, as well as rotation through at least two research laboratories, will be done for the purposes of familiarizing students with various projects in the department. Near the end of their first year of graduate study, students will be required to submit to the Chairman the names of three preferred mentors, listing these in order of preference. The Chairman, with the student's preferences in mind, will make the final decision on mentor selection following input from the Executive Committee and the Director of the Graduate Program. The decision of assigning a mentor to a student will be based on several factors including the financial ability of the laboratory to support the student's stipend, research and travel, the availability of space, the mentor's time for that student, the quality of the proposed project, and the mentor's track record with previous students.

General Requirements

Attendance requirements: As preparation for a career in microbiology, graduate students are expected to attend all classes and seminars. When not in class or seminars graduate students are expected to be in the department engaged in academic work or

laboratory research. Students are expected to perform research activities at a level defined by their mentor and advisory committee.

Academic performance: Students can be dismissed from the program for cause (e.g., plagiarism, cheating, harassment, etc.) or for poor academic performance. This includes:

- A) Failure to achieve a grade of >80% in the Medical Microbiology Course (MICRO 701).
- B) Failure to maintain an overall GPA of >80% for two consecutive semesters.
- C) Scoring less than 80% in two of the three graduate microbiology courses (i.e., Bacterial Structure and Function (MICRO 725), Experimental Immunochemistry and Immunobiology, (MICRO 733), and Viruses (MICRO 702). Students who score <80% in two of these courses will be limited to a MS degree.

Professional conduct: It is both expected and mandatory that all students adhere to the highest levels of honesty and research integrity. Misconduct such as academic dishonesty (cheating), fabrication of data, falsification or misreporting research findings, plagiarizing the words or ideas of others undermine scientific integrity. Communicating with other students during examination is an unacceptable behavior. Students engaging in these practices will be disciplined and, if the offense warrants, dismissed from the Microbiology Graduate Program entirely upon majority vote of the faculty.

Requirements for a Master of Science Degree

Beginning in August 2008, all students entering the graduate program in microbiology will earn a MS degree in Biomedical Sciences. A minimum of 30 semester hours in graded courses is required for a MS degree. While a thesis is not required for students pursuing a PhD degree, students seeking a terminal MS degree may opt to write a thesis. Although individual courses of study may vary, a representative MS program is shown below:

MICRO 701 Medical Microbiology (12 hrs)
BIOCH 710 Medical Biochemistry (10 hrs)
MICRO 733 Experimental Immunology (3 hrs)
MICRO 702 Viruses (3 hrs)
MICRO 725 Bacterial Structure and Function (3hrs)
MICRO 708 Preparation for Instruction in Microbiology (3 hrs)
MICRO 703 Seminar in Microbiology Science (1 hr)
MICRO 707 Microbiology Laboratory Rotation (3 hrs)
ID 709 Responsible Conduct of Research (2 hrs)
PM 740 Statistical Methods In Research I (3 hrs)
ID 710 Research Tools in Molecular Biology (2 hrs)

The following only applies to students seeking a MS degree with thesis. At the end of the first graduate year, the student in consultation with his/her mentor will nominate two additional members of the graduate faculty to serve on his/her thesis advisory committee. This Committee will review the student's progress in research and evaluate the resulting thesis. The thesis shall be completed within three years from the date of admission into

the program; any extension of this deadline must be approved by a vote of the faculty. Upon defense of the thesis, the student is expected to present a seminar on the research. A quality MS thesis should result in a manuscript suitable for publication. Applicable information regarding deadlines and forms required by the graduate school are found in **A Handbook for Students in the School of Graduate Studies in the Health Sciences**.

Requirements for a Doctor of Philosophy Degree

The PhD Program at the University of Mississippi Medical Center requires successful completion of a minimum of 45 semester hours of graded courses. Beginning in August 2008, all students entering the graduate program in microbiology, will be required to earn a MS degree prior to pursuing work on their PhD degree. A thesis may or may not be required. For students entering with a B.S. or B.A. degree, the standard PhD curriculum consists of the following:

- Credit Hours earned as part of the MS in Biomedical Sciences: at least 30 credit hours
- MICRO 750 Research Proposal (3 hrs)
- MICRO 703 Seminar in Microbiology Science (2-3 hrs)
- ID 714 Professional Skills for Graduate Students and Postdoctoral Fellows. (3 hrs)
- An advanced course in Virology (MICRO 735), Immunology (MICRO 734), or Bacteriology (MICRO 734) (2 hr) or a special topics course.

For students entering with an MS degree or prior graduate work, course requirements and transfer of graduate level courses from another institution will be determined on an individual basis by the Director of the Graduate Program in Microbiology. However, courses to be transferred must be appropriate to the student's course of study and must be limited to less than half of the hours required for graduation. Students must apply for transferring credits using forms available at the registrar's office.

Qualifying Examination

At the end of the student's second year of graduate study, the prospective PhD student must pass a qualifying examination for admission to candidacy for the PhD degree. The qualifying exam consists of two parts, a written and an oral exam. The written exam consists of four questions, one from each of the following areas: 1) bacteriology, 2) immunology, 3) virology and 4) medical microbiology. Students need to score 75% on the written exam to pass. Only students who successfully pass the written exam are allowed to take the oral exam. The oral examination will be given by a standing qualifying examination committee. The committee will examine the student and also consider a report from the mentor relative to the student's progress in research. Students, who fail the written qualifying examination, are allowed to retake the written exam once. However, if the student fails the written exam a second time, the committee will recommend to the faculty that the student not be admitted to the PhD program. Note: If the student has successfully completed requirements for a MS in Biomedical Science, the student may receive the MS as a terminal degree. In case of an unsatisfactory performance on the oral qualifying examination, the qualifying examination committee may allow the student to repeat the exam; the ability to repeat the oral exam will be determined by a majority vote of the exam committee. Satisfactory performance on the qualifying examination (written

and oral) will result in a recommendation for admission to candidacy directly or after completion of defined remedial work as determined by a majority vote of the examination committee.

After successfully completing the qualifying examination, the student must complete the **Application for Admission to Candidacy for the Degree of Doctor of Philosophy** form and the **Qualifying Examination Form** (to be signed by all members of the examination committee) and submit these, along with a copy of his/her transcript, to the Graduate Office. Copies of these forms may be found in **A Handbook for Students in the School of Graduate Studies in the Health Sciences**. Upon successful entry into candidacy, the student must complete his/her PhD requirements within five years.

Advisory Committee: The student in consultation with his/her mentor will nominate an Advisory Committee. The committee will consist of at least five members of the graduate faculty, at least four from within the Department of Microbiology and at least one from outside the department. Once the faculty desired for the committee are determined, the **Nomination of Advisory Committee Form** should be submitted to the Director of the Graduate Program in Microbiology who will, in turn, submit this form to the Graduate Office for approval.

Research proposal: Near the end of the third to fourth years of graduate study, students who have been admitted to candidacy for the PhD will prepare and submit to each member of the Advisory Committee a written research proposal (in the form of an NIH grant application) detailing the research planned for completion of the PhD. At the same time, a student must provide each member of the Advisory Committee with a copy of a manuscript, on which the student is the first author, which has either been published or submitted for publication to a peer-reviewed journal. The research proposal will be presented in oral form to the advisory committee either in private or as a departmental seminar and the committee, in subsequent private deliberation, will evaluate the feasibility and appropriateness of the proposal and advise the student accordingly. Each committee member will grade the proposal based on an agreed upon rubric and the majority vote will determine if the proposal has been approved. At the discretion of the mentor, the student may present his/her research findings and an outline of their proposed research to the entire department prior to the private meeting of the advisory committee.

Dissertation, final oral examination and publication requirement: Requirements for successful completion of the PhD are three-fold: (1) a written dissertation describing the student's original research submitted to each member of the a student's Advisory Committee who will in private deliberation determine the acceptability of the dissertation and the defense of the dissertation, (2) a public oral presentation of the dissertation research, and (3) at least one peer-reviewed, first author publication describing original research done by the student in a major scientific journal. **Submission of the dissertation to the Advisory Committee and defense of dissertation may not take place until the student has published or "in press" (accepted for publication) a paper describing original research done by the student and listing the student as first author on the paper. Publication must be in a peer-reviewed journal; review papers or book chapters do not fulfill the publication requirement.** The dissertation should be submitted to the committee two weeks prior to the committee meeting at which it will be determined whether or not the dissertation is defensible. At this meeting the

closed oral examination and thesis defense will take place. If the dissertation is deemed acceptable the student shall submit a letter to the director of the graduate program and the chairman of the department providing the title of the dissertation, the expected date of the public dissertation defense, and a list of publications. If the student's paper is not yet published, a letter of acceptance from the journal's editorial office must be included with the letter. On receipt of that letter, the director of the graduate program will schedule the student's public defense and notify the School of Graduate Studies in the Health Sciences.

The **Application for Diploma** form and if applicable the **Cap and Gown Order** form should be returned to the Registrar at the beginning of the semester in which the student expects to graduate. Consult the Bulletin to determine the last date on which all forms and requirements must be completed for participation in graduation, and the **Handbook for Students in the School of Graduate Studies in the Health Sciences** for additional graduation/dissertation requirements.

Requirements for a M.D./PhD degree

For students pursuing an M.D./PhD degree the general requirements outlined in the University bulletin apply. Credit earned in medical school courses will count toward graduate school requirements. In addition, the combined degree candidate must take additional 10 semester hours of courses within the Department of Microbiology, outside of the medical curriculum. Since the proposed time allotted for the PhD portion of the combined degree is short (3 years) and since research should be a major component of the program, it is advisable that the student completes the bulk of his/her course requirements within the first year of graduate school. The courses required during this year will be determined based on the recommendations of the student's advisory committee. Whereas individual plans may vary, for a student working in the area of bacteriology, for example, the required courses may include the following:

- MICRO 725 Bacterial Structure and Function (3 hrs)
- MICRO 733 Experimental Immunology (3 hrs)
- MICRO 747 Advanced Medical Bacteriology (2 hr).
- MICRO 750 Research Proposal (3 hrs)
- MICRO 703 Seminar in Microbiology (2 - 3 hrs)
- MICRO 707 Microbiology Laboratory Rotation (3 hrs)
- ID 709 Responsible Conduct of Research (2 hrs)

DESCRIPTIONS OF GRADUATE COURSES IN MICROBIOLOGY

MICRO. 701. MEDICAL MICROBIOLOGY. The fundamentals of microbial physiology, genetics and immunology are presented with important bacterial, viral, parasitic and mycotic infections discussed from the standpoint of etiology, epidemiology, pathogenesis and laboratory diagnosis. Participation in laboratory exercises and small group sessions is required. (12 semester hours; 6-6)

MICRO. 702. VIRUSES. A survey of animal viruses with emphasis on pertinent aspects of molecular biology. Prerequisites: Microbiology 701 and Biochemistry 710. (3 semester hours)

MICRO. 703. SEMINAR IN MICROBIOLOGY. (1 semester hour)

MICRO. 704. RESEARCH IN MICROBIOLOGY. (Hours/credit, TBA)

MICRO. 707. MICROBIOLOGY LABORATORY ROTATION. This course is designed to acquaint the student with ongoing research and research methodologies within the department. To accomplish this, the student will actively take part in ongoing research projects in one or two laboratories during the semester. (3 semester hours)

MICRO. 708. PREPARATION FOR INSTRUCTION IN MICROBIOLOGY. The student will participate in the preparation of microbiological cultures and assist faculty in the teaching of the medical microbiology laboratory course. Prerequisite: MICRO 701. (3 semester hours.)

MICRO. 725. BACTERIAL STRUCTURE AND FUNCTION. A study of bacterial physiology, anatomy and regulatory mechanisms. Prerequisite: Microbiology 701 and Biochemistry 710. (3 semester hours.)

MICRO. 733. EXPERIMENTAL IMMUNOCHEMISTRY AND IMMUNOBIOLOGY. Theoretical and experimental applications of immunochemistry and immunobiology with major emphasis on in vivo and in vitro techniques used in investigating various aspects of humoral and cell-mediated immune responses. Prerequisite: Microbiology 701 or equivalent. (3 semester hours.)

MICRO. 734. ADVANCED IMMUNOLOGY. An advanced course in which students discuss and critically review new research findings in various aspects of human and comparative immunology. Prerequisites: MICRO 701, MICRO 733. (2 semester hours)

MICRO. 735. VIRAL BIOCHEMISTRY. An advanced course in which students study, discuss and critically review new research findings, concepts and laboratory techniques in the areas of viral biochemistry, molecular biology, tumor virology and medical virology. Prerequisites: Microbiology MICRO. 701, Biochemistry 710 and Microbiology 702. (2 semester hours)

MICRO. 741. MICROBIOLOGY. Basic concepts in microbiology and immunology are presented and correlated with disease processes having a bacterial, viral, mycotic or parasitic etiology. The relevance of microbial pathogens in both general and dental medicine is discussed. Spring (6 semester hours) (NOTE: This course is also listed as Dental 641 and is not offered to graduate students within the microbiology program).

MICRO. 747. ADVANCED BACTERIOLOGY. This course will offer small group sessions that address the mechanisms of infection and host defense. This will include lectures, case presentations, laboratory exercises, etc. (1 semester hour).

MICRO. 750. RESEARCH PROPOSAL IN MICROBIOLOGY. An advanced course in which doctoral students prepare and defend a research grant proposal focused on their dissertation research. (3 semester hours.)

MICRO. 715. SPECIAL TOPICS IN MICROBIOLOGY. (Hours/credit TBA)

MICRO. 798. DISSERTATION AND DISSERTATION RESEARCH. (Hours/credit TBA)

MICRO. 799. THESIS AND THESIS RESEARCH. (Maximum of 6 semester hours)

NOTE: The following four courses comprise distinct sections of the larger MEDICAL MICROBIOLOGY course (MICRO 701). Students OUTSIDE THE DEPARTMENT OF MICROBIOLOGY interested in aspects of the larger course may register for those specific sections of the course listed below.

MICRO. 760. MEDICAL VIROLOGY (3 semester hours.)

MICRO. 761. MEDICAL IMMUNOLOGY (3 semester hours.)

MICRO. 762. MEDICAL BACTERIOLOGY (6 semester hours.)

MICRO. 763. MEDICAL PARASITOLOGY/MYCOLOGY (1 semester hour.)