BS in Microbiology
Department of Veterinary Pathobiology
University of Missouri

Advising Handbook

2019-2020
Welcome!

Microbiology, which includes the sub-disciplines of bacteriology, virology, mycology, parasitology, and immunology, is a cornerstone discipline in the fields of public health, food safety, medicine, veterinary medicine, dentistry, biotechnology, and biomedical research. Microscopic organisms (microbes) have had a significant impact on human history and activities and are more important today. As examples, antibiotic resistance is a worldwide public health problem, food recalls due to organisms such as *Salmonella* and *Listeria* are commonplace, and emerging viral pathogens such as Ebola, Zika, and West Nile are frequently in the news. The microorganisms present on and in our bodies (the microbiome) impact our health and our immune system can be exploited to treat diseases such as cancer in the growing field of personalized medicine.

Microbiology is an attractive area of study because of its central position in the study of basic life sciences, its close connection to medical fields, and its direct role in biotechnology. The recent explosive growth of biotechnology depends heavily on using microorganisms to produce biomedical and industrial products, and so has created a large demand for correspondingly trained personnel at both the Bachelor of Science (BS) and more advanced levels.

The Department of Veterinary Pathobiology offers a BS degree in Microbiology and will be adding a minor in Microbiology for students majoring in other departments. The BS degree program offers broad training both for students who plan to enroll in graduate or medical/dental/veterinary medical or other health profession schools, as well as for those who will seek positions in biotechnology research or with hospital, university or government laboratories upon graduation.

The undergraduate Microbiology curriculum offers unique coursework and undergraduate research opportunities. An honors program in Microbiology permits qualified students to graduate with departmental honors and will be noted as such on your diploma and transcript.

We hope that this handbook will be helpful whether you already have chosen or are considering a major in microbiology. This handbook does not contain all the University rules, requirements and regulations. You may view a copy of the MU Undergraduate Course Catalog online for additional information. Also, requirements, courses, and even prerequisites change. We won't always be able to tell you personally about these changes, but we will post the changes to the Department of Veterinary Pathobiology website.

Director of Undergraduate Studies:
Dr. George C. Stewart
201 Connaway Hall
Degree Requirements:

Students will be required to complete 120 hours of credit with an overall GPA of 2.0 in order to graduate. The distribution of these hours is as follows: 39 credit hours of general education requirements, 60-61 credit hours of major requirements, and 19-20 credit hours of free electives.

Students must complete all general education requirements with a grade of C- or better. Students must receive a grade of C- or higher in all microbiology and related science courses (biology, chemistry, physics, mathematics) that are used to fulfill the requirements for a bachelor of science in microbiology (BSM) degree. Students must also maintain a GPA of 2.0 or higher in all microbiology and related science courses taken at the University of Missouri in fulfillment of the BSM degree requirements. Lastly, students must maintain a GPA of 2.0 for their final 60 hours and final 30 hours. Note that a grade of C- equates to a GPA of 1.7 on a 4.0 scale.

Residency Requirements:

The final 30 credit hours must be taken at the University of Missouri. Twelve hours of microbiology at the 3000 level or above must be completed at MU.

Admission:

Students who wish to be admitted to the BS in Microbiology degree program must meet the general admission requirements for all students applying to the University of Missouri. Please refer to https://admissions.missouri.edu/requirements/ for the most current information on the admission process. Once admitted to the University of Missouri, admission to the BSM program is open with no additional requirements. Although not required, prospective students are strongly encouraged to build a solid foundation in math and science prior to admission to the BSM program.

General Education Requirements

https://generaleducation.missouri.edu/requirements/

All general education requirements must be completed with a grade of C- or better. Courses taken to fulfill the general education requirements cannot be taken using the Satisfactory/Unsatisfactory grading system.

- English Exposition and Argumentation (3 credits)
  English 1000 or 1000H or transferable equivalent

- Math and Quantitative Reasoning (3 credits)
  Math 1050, 1100, 1160, STAT 1200, or transferable equivalent
  The requirement can also be satisfied by completing a calculus course (Math 1320, 1400, 1500/1500H, 1700/1700H, or 2300/2300H) that provides back-credit for Math 1100 or 1160 or by passing the proctored Math Placement Exam http://mathplacement.missouri.edu/ with a sufficient score.

- Writing Intensive Course (3 credits)
  Three credits of writing intensive-designated coursework from anywhere in the University curriculum or from an English Composition I transfer course equivalent from a Missouri regionally-accredited institution (ENGLISH 1010W). This course may also be applied toward the Distribution of Content requirement.
American History or Government (3 credits)
The following courses will satisfy this Missouri requirement:

**History courses**
1100/1100H: Survey of American History to 1865
1200/1200H: Survey of American History since 1865
1400: American History (no longer offered but still accepted for AP credit)
2210: Twentieth Century America
2440: History of Missouri
4000: Age of Jefferson
4220: U.S. Society Between the Wars 1918-1945
4230: Our Times: United States since 1945

**Political Science courses**
1100/1100H: American Government
2100/2100H: State Government

Designated courses may also be used toward the distribution of content requirement.

Distribution of Content (27 credits)
The distribution of content requirement of 27 credits is designed to provide a breadth and depth of knowledge in three broad areas of study. There are three different areas of distribution; 9 credit hours are required in each area. At least one course numbered 2000 or above is required in two of the three areas of distribution.

The distribution of content must include:

- Nine credits of Biological Science, Physical Science, and/or Mathematical Science. Please note that:
  - At least one biological or physical science and its related laboratory component must be taken.
  - Two different areas of science must be represented.

- Nine credits of Behavioral and/or Social Science including courses from at least two different departments in these areas. Note that designated courses for the American History or Government requirement may also be counted toward the distribution of content requirement.

- Nine credits of Humanities and/or Fine Arts including courses from at least two different departments in these areas.

Requirements for the Microbiology Major
The following courses are required for the microbiology major. All courses must be taken for a letter grade (satisfactory/unsatisfactory grades will not count toward the major). A grade of C- or higher is required for each class and an overall GPA of 2.0 for these courses is also required.

- PHYSCS 1210 College Physics I or PHYSCS 2750 University Physics I
• PHYSCS 1220 College Physics II or PHYSCS 2760 University Physics II
• BIO_SC 1500 Introduction to Biological Systems with Laboratory
• MATH 1400 Calculus for Social and Life Sciences I or MATH 1500 Analytical Geometry and Calculus I
• CHEM 1320 College Chemistry I
• CHEM 1330 College Chemistry II
• CHEM 2100 Organic Chemistry I
• CHEM 2110/2130 Organic Chemistry II and Organic Laboratory I
• BIOCHM 3630 General Biochemistry or BIOCHM 4270 Biochemistry I
• V_PBIO 2001 Fundamentals of Microbiology with lab or BIO_SC 3750 and BIO_SC 3760
• V_PBIO 3551 Introduction to Immunology I
• V_PBIO 3554 Introduction to Virology or V_PBIO 3345 Fundamentals of Parasitology
• V_PBIO 3600 Bacterial Genetics and Genomics
• V_PBIO 4970 Microbiology Undergraduate Research or V_PBIO 4980 Microbiology Senior Seminar (Capstone)
• MICRO 3200 Medical Microbiology and Immunology
• Microbiology Electives (15 credit hours selected from the following):
  BIOCHM 4272 Biochemistry II
  BIO_SC 2300 Cell Biology
  BIO_SC 4976 Molecular Biology
  ENV_SC 4312: Environmental Soil Microbiology
  F_S 2172 Elements of Food Microbiology
  F_S 4370 Food Microbiology
  F_S 4375 Food Microbiology Laboratory
  MICRO 4304 Immunology II
  V_PBIO 2950 Undergraduate Research in Microbiology
  V_PBIO 3345 Fundamentals of Parasitology*
  V_PBIO 3554 Virology*
  V_PBIO 3557 Microbial Pathogenesis I
  V_PBIO 3558 Microbial Pathogenesis II
  V_PBIO 3650 Applied Microbiology and Biotechnology
  V_PBIO 3560 Microbial Physiology
  V_PBIO 3658 Public Health Microbiology
  V_PBIO 3700 Medical and Veterinary Entomology
  V_PBIO 3950W Current Topics in Emerging Infectious Disease
  V_PBIO 3900W Beneficial Microbes
  V_PBIO 4950 Undergraduate Research**

*One of these 2 courses must be taken as a major requirement; the other can be taken as a major elective.
**Can be repeated for a maximum of 6 credit hours.

If all degree requirements are met, microbiology majors who enroll in the MU College of Veterinary Medicine prior to receiving their baccalaureate degree will be eligible to receive the BSM degree at the end of their second year in the professional curriculum. The following course substitutions for required core courses will be accepted:
• V_PBIO 5552 Veterinary Bacteriology and Mycology I and V_PBIO 5553 Veterinary Bacteriology and Mycology II for MICRO 3200 Medical Microbiology and Immunology
• V_PBIO 5511 Veterinary Immunology 1 and V_PBIO 5512 Veterinary Immunology 2 for V_PBIO 3551 Introduction to Immunology
• V_PBIO 5557 Veterinary Parasitology for V_PBIO 3345 Fundamentals of Parasitology

The following courses will be accepted as major electives:

• V_PBIO 5554 Veterinary Virology
• V_PBIO 5555 Veterinary Epidemiology and Biostatistics
• V_PBIO 5558 Veterinary Public Health

Requirements for Graduation

• Satisfactory completion (grade of C- or better) of a 3 credit upper division writing intensive class in the microbiology major. Acceptable classes are:
  ANTHRO 3560W Plagues and Peoples
  HLTH_SC 3900W Introduction to the Research Process and Evidence Base
  V_PBIO 3950W Current Topics in Emerging Infectious Disease
  V_PBIO 3900W Beneficial Microbes

• Additional electives to meet the 120 credit hour minimum for graduation. These electives can be taken using the satisfactory/unsatisfactory grading system if in compliance with university academic policies.

Common Credit Limitations

The University has established limitations on receiving credit for multiple courses if very similar in content. These limitations are applicable to all undergraduate students, regardless of degree program. Refer to [http://catalog.missouri.edu/academicdegreerequirements/commoncreditlimitations/](http://catalog.missouri.edu/academicdegreerequirements/commoncreditlimitations/) for further information.

Graduating with Honors in Microbiology

The Department of Veterinary Pathobiology offers an honors program for qualifying students enrolled in the Bachelor of Science in Microbiology major. The Honors Program in Microbiology is designed to provide exceptional students with opportunities to develop research and analytical skills beyond that obtained in the regular course of study. Students who attain this level of achievement will be acknowledged with the notation of “BS in Microbiology with Honors” on their diplomas and transcripts. Students are not required to be enrolled in the MU Honors College to participate.

Eligibility for Acceptance into the Honors Program

1. Completion of 45 credit hours. Transfer students must have completed at least 15 hours of credit through MU.
2. Cumulative GPA of 3.30 or higher
Students must complete the “Honors Program Application” and submit it to the Undergraduate Microbiology Program Director to be accepted into the Honors program. Upon acceptance, a research mentor/advisor will be selected.

To receive the BS in Microbiology with Honors distinction, students will be required to satisfy all of the following criteria:

1. Satisfy the BS degree requirements
2. Maintain a cumulative GPA of at least 3.30
3. Complete six credit hours of research (Undergraduate Research V_PBIO 4950 and V_PBIO 4970)*
4. Present to the Undergraduate Microbiology Program Director one of the following:
   a. A poster or an abstract of an oral presentation given by the student at a scientific meeting
   b. A manuscript describing the student’s research written in a format suitable for publication in a scientific journal
   *Note that steps 3 and 4 combined can also be used to fulfill the capstone requirement for graduation.
5. In the last semester of studies before graduation, inform the Undergraduate Microbiology Program Director that you will satisfy the honors requirement so that the Registrar can be notified and the honors recognition placed on your diploma and transcript.
## SAMPLE COURSE OF STUDY

<table>
<thead>
<tr>
<th>Year 1 Fall</th>
<th>Credits</th>
<th>Year 1 Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLISH 1000 Exposition and Argumentation</td>
<td>3</td>
<td>V_PBIO 2001 Fundamentals of Microbiology with lab</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 1320 College Chemistry I</td>
<td>4</td>
<td>CHEM 1330 College Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1100 or 1120 College Algebra</td>
<td>3</td>
<td>MATH 1400 or 1500 MATH 1400 Calculus for Social and Life Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>BIO_SC 1500 Introduction to Biological Systems and Laboratory</td>
<td>5</td>
<td>Gen Ed Requirements</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2 Fall</th>
<th>Credits</th>
<th>Year 2 Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 2100 Organic Chemistry I</td>
<td>3</td>
<td>CHEM 2110/2130 Organic Chemistry II and Organic Laboratory I</td>
<td>5</td>
</tr>
<tr>
<td>MICRO 3200 Medical Microbiology and Immunology</td>
<td>4</td>
<td>Free Elective</td>
<td>1-3</td>
</tr>
<tr>
<td>Gen Ed Requirement</td>
<td>6</td>
<td>Gen Ed Requirement</td>
<td>6</td>
</tr>
<tr>
<td>Free Electives</td>
<td>3</td>
<td>Major Elective</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td><strong>Total</strong></td>
<td><strong>15-17</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3 Fall</th>
<th>Credits</th>
<th>Year 3 Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSCS 1210 College Physics I</td>
<td>4</td>
<td>PHYSCS 1220 College Physics II</td>
<td>4</td>
</tr>
<tr>
<td>V_PBIO 3551 Introduction to Immunology I</td>
<td>3</td>
<td>Major Elective</td>
<td>6</td>
</tr>
<tr>
<td>BIOCHM 3630 General Biochemistry</td>
<td>3</td>
<td>Free Electives</td>
<td>3</td>
</tr>
<tr>
<td>Free Elective</td>
<td>3</td>
<td>Gen Ed Requirement</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 4 Fall</th>
<th>Credits</th>
<th>Year 4 Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_PBIO 4950 Microbiology Undergraduate Research OR V_PBIO 4980 Microbiology Seminar Capstone</td>
<td>3</td>
<td>V_PBIO 3600 Bacterial Genetics and Genomics</td>
<td>3</td>
</tr>
<tr>
<td>Major Electives</td>
<td>3</td>
<td>Major Elective or V_PBIO 4970 Microbiology Undergraduate Research Capstone</td>
<td>3</td>
</tr>
<tr>
<td>V_PBIO 3554 Introduction to Virology</td>
<td>3</td>
<td>Gen Ed Requirement</td>
<td>3</td>
</tr>
<tr>
<td>Gen Ed Requirement</td>
<td>3</td>
<td>Free Elective</td>
<td>6</td>
</tr>
<tr>
<td>Free Elective</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>