Department of Microbiology, Immunology and Pathology  
M.S.-A (Thesis) and Ph.D. Program Overview

I. Introduction
The research programs of the Department of Microbiology, Immunology and Pathology (MIP) provide excellent opportunities for graduate training at the M.S., Ph.D., D.V.M./Ph.D. and combined Ph.D. and M.S./residency levels in fundamentals of modern investigative microbiology, immunology and pathobiology. Areas of research strength in the department include bacteriology, mycobacterial diseases, prion biology, vector-borne infectious diseases, virology and the emerging area of computational biology. An emphasis is placed on a multi-disciplinary approach to research problems. This is facilitated by collaborations with major research groups within the College of Veterinary Medicine and Biomedical Sciences. Interpretive diagnostic expertise training is also provided in conjunction with the Veterinary Teaching Hospital and the Veterinary Diagnostic Laboratory.

II. Graduate Student Advisers and the First Year of Study
Unless a student is supported by funds from an individual investigator, the Associate Department Head for Graduate Education serves as a temporary advisor for first year students. The temporary advisor assists in selection of courses and helps the student identify faculty members whose academic and research interests coincide with the student’s educational goals.

A. Teaching
Students admitted into the MIP graduate program may be assigned teaching duties in the undergraduate courses offered by MIP. These students are required to attend the GTA Workshop presented by the Institute for Learning and Teaching (TILT) and the Graduate School, which is held the week before Fall semester classes begin. Colorado State University offers a Graduate Teaching Certificate Program, which you can work towards during your teaching assistantship in the first year of your M.S. or Ph.D. This is a great opportunity to get credit for your teaching hours and to put together a teaching portfolio with help from experienced faculty.

B. Laboratory Rotations
Students admitted into the MIP graduate program contact faculty members to arrange two laboratory rotations during the first semester; each rotation is approximately 8 weeks in length. Students have an opportunity to perform a 3rd or 4th rotation during their second semester, as needed. The Associate Department Head for Graduate Education will assist students in the selection of research laboratories. By the end of the first two semesters of study, a permanent faculty research advisor is identified and approved by the GEC and Department Head.

III. University and Department Course Requirements and Program of Study
The student and the student’s graduate committee share responsibility for formulating the coursework in the students' program of study. The program of study for students is based on the student’s academic background, area of specialization, and recommendations of the graduate committee. Students must fulfill the core area requirements for their degree program. The core
departmental areas are defined as bacteriology, virology, molecular genetics (molecular biology), immunology, vector biology and pathobiology (includes prion biology, toxicology, and cancer biology).

A. The Student’s Graduate Committee
After identifying a faculty research advisor, the student and major advisor will propose the membership of a graduate committee.

Composition of the Graduate Committee
The student's graduate committee is composed of at least three members for the M.S. program and at least four members for the Ph.D. program, including the major advisor. The students' major advisor chairs the committee. The committee must have at least one member from outside the MIP Department. The chair must be a member of the Microbiology, Immunology and Pathology faculty. In consultation with the major advisor and the graduate committee, a program of study will be formulated.

The student’s graduate committee is responsible throughout the remainder of the student’s graduate career for advice on course work and evaluation of progress in the program. The committee will advise and guide the student in the execution of the research program.

B. Master of Science Degree
Credit requirements
Each Master of Science student shall acquire an in-depth knowledge in an area of research and breadth of knowledge by completing formal coursework in two of the core areas defined above. A minimum of 30 credits in courses (numbered 300 or above) and research is required. At least 24 credits must be earned at Colorado State University; 16 of the 24 must be in courses numbered 500 or above and 12 credits should be in regular courses (excludes MIP698 research, MIP699 thesis, MIP700 topics in microbiology, MIP784 supervised teaching, and MIP792 seminars). The department requires that 9 of the 12 credits be earned in Microbiology, Immunology and Pathology courses.

M.S. Graduate Program minimum course requirements
MIP700- Topics in Microbiology, 1 credit each year (MS- at least 2 semesters)
MIP792A- Seminar- Research/Graduate, 1 credit each semester
MIP654- Research Policies and Regulations or GRAD544- Ethical Conduct in Research

M.S. Graduate Program average time to completion is 2.5-3 years.

C. Doctor of Philosophy Degree
Credit Requirements
Each Ph.D. student shall acquire in-depth knowledge in the selected area of research specialization(s) and breadth of knowledge by completing formal coursework in three of the core areas defined above. Adequate knowledge in general biological and physical sciences is also required. To be recommended for candidacy, in addition to completing the required coursework, students must demonstrate to the satisfaction of their graduate committee that they possess the knowledge, abilities and skills essential for the specialization chosen.

For the Ph.D. degree a minimum of 72 credits in courses (numbered 300 or above) and research is required. An appropriate master's degree or DVM/VMD or equivalent from an accredited college or university may be recommended by the GEC for approval for a maximum of 30 credits. At least
21 credits beyond the M.S. degree are to be earned in courses numbered 500 and above and 16 credits should be in regular courses (excludes MIP798 research, MIP799 dissertation, MIP700 topics, MIP784 supervised teaching, and MIP792 seminars). The department requires that 13 of the 16 credits be earned in Microbiology, Immunology and Pathology courses.

**Ph.D. Graduate Program minimum course requirements**

Required courses:
- MIP700- Topics in Microbiology, 1 credit each year (PhD- at least 4 semesters)
- MIP792A- Seminar- Research/Graduate, 1 credit each semester
- MIP654- Research Policies and Regulations, 1 credit
  - or GRAD544- Ethical Conduct in Research
  - or CM666- Science and Ethics

Highly recommended:
- MIP540- Biosafety in Research Laboratories, 2 credits
- MIP643- Grant Writing for Microbiology/Pathology, 1 credit
- MIP666- Writing Scientific Manuscripts, 3 credits

**Ph.D. Graduate Program average time to completion is 4.5-5 years.**

**Preliminary Examination for Admission to Candidacy for the Ph.D.**
The Doctor of Philosophy student gains admission to candidacy by passing a comprehensive preliminary examination. The preliminary examination consists of preparation of a written research proposal and an oral exam, which covers the candidate’s entire program of study. The preliminary examination is to be administered by the end of the 5th semester in the graduate program (Fall semester of the third year).

**D. Graduate Seminars and Presentations**
All graduate students are required to register for graduate seminar (MIP792A) and regularly attend weekly seminars during the fall and spring semesters. Graduate students are required to present a seminar every other academic year during their graduate studies, beginning in the second year. Final defense seminars may be presented as part of the weekly graduate seminar series or separately.

**E. MIP Graduate Curriculum - MS-A and PhD Programs**

**MS-A & PhD Credit Requirements**

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<thead>
<tr>
<th></th>
<th>MS-A</th>
<th>PhD</th>
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<tbody>
<tr>
<td>30 credits total</td>
<td>72 credits total</td>
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<tr>
<td>24 credits at CSU</td>
<td>24 credits at CSU (30 credits can be applied from MS or DVM degree)</td>
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<tr>
<td>16 credits must be 500+</td>
<td>21 credits must be 500+ (beyond MS/DVM if applicable)</td>
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<tr>
<td>12 credits must be regular courses*</td>
<td>16 credits must be regular courses*</td>
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<tr>
<td>9 credits must be regular courses* with MIP prefix</td>
<td>13 credits must be regular courses* with MIP prefix</td>
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*Regular course work is defined as courses other than seminars, topics, independent or group studies, research credits, thesis/dissertation credits, and supervised college teaching.
<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>Offered</th>
<th>Credits</th>
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<tbody>
<tr>
<td><strong>Required Courses</strong></td>
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</tr>
<tr>
<td>MIP700 -Topics in Microbiology, Immunology and Pathology</td>
<td>Fall and Spring</td>
<td>1</td>
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<tr>
<td>MIP792A - Graduate Student Seminar</td>
<td>Fall and Spring</td>
<td>1</td>
</tr>
<tr>
<td>MIP654 - Research Policies and Regulations</td>
<td>Fall</td>
<td>1</td>
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<tr>
<td><strong>General Electives</strong></td>
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<tr>
<td>MIP540 -Biosafety in Research Laboratories</td>
<td>Spring</td>
<td>2</td>
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<tr>
<td>MIP643 -Grant Writing for Microbiology/Pathology</td>
<td>Spring</td>
<td>1</td>
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<tr>
<td>MIP666 -Writing Scientific Manuscripts</td>
<td>Fall even years</td>
<td>3</td>
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<tr>
<td>MIP780A3 -Research Teams Mentoring</td>
<td>Spring</td>
<td>1</td>
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<tr>
<td><strong>Virology Electives</strong></td>
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<tr>
<td>MIP533 -Epidemiology of Infectious Disease</td>
<td>Spring</td>
<td>3</td>
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<tr>
<td>MIP543 -RNA Biology</td>
<td>Fall odd years</td>
<td>3</td>
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<tr>
<td>MIP555 -Principles and Mechanisms of Disease</td>
<td>Fall</td>
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<tr>
<td>MIP581A5 -Advanced Virology - Fundamentals/New Insights</td>
<td>Spring even years</td>
<td>1</td>
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<tr>
<td>MIP581A6 -Advanced Virology - Mechanisms of Viral Disease</td>
<td>Spring even years</td>
<td>1</td>
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<tr>
<td>MIP581A7 -Advanced Virology - Discovery Tools and Control</td>
<td>Spring even years</td>
<td>1</td>
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<tr>
<td>MIP680A4 -Fundamentals of Infectious Disease Immunity</td>
<td>Spring odd years</td>
<td>1</td>
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<tr>
<td>MIP680A5 –Immunity to Viruses</td>
<td>Spring odd years</td>
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<tr>
<td><strong>Bacteriology Electives</strong></td>
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<tr>
<td>MIP550 -Microbial and Molecular Genetics Laboratory</td>
<td>Spring</td>
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<tr>
<td>MIP555 -Principles and Mechanisms of Disease</td>
<td>Fall</td>
<td>3</td>
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<tr>
<td>MIP577 -Computer Analysis in Population Genetics</td>
<td>Fall</td>
<td>2</td>
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<tr>
<td>MIP578 -Genetics of Natural Populations</td>
<td>Fall</td>
<td>4</td>
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<tr>
<td>MIP630 -Advances in Microbial Physiology</td>
<td>Fall even years</td>
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<tr>
<td>MIP580B1 -Intro to Mechanisms of Bacterial Pathogenesis</td>
<td>Fall</td>
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<tr>
<td>MIP580B2 -Bacterial Pathogenesis Mechanisms &amp; Lifestyle</td>
<td>Fall</td>
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<tr>
<td>MIP580B3 -Bacterial Pathogenesis –Evading Host Defenses</td>
<td>Fall</td>
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<tr>
<td>MIP680A4 -Fundamentals of Infectious Disease Immunity</td>
<td>Spring odd years</td>
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<tr>
<td>MIP680A6 -Immunity to Bacteria and Parasites</td>
<td>Spring odd years</td>
<td>1</td>
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<tr>
<td><strong>Vector Biology Electives</strong></td>
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<tr>
<td>MIP577 -Computer Analysis in Population Genetics</td>
<td>Fall</td>
<td>2</td>
</tr>
<tr>
<td>MIP578 -Genetics of Natural Populations</td>
<td>Fall</td>
<td>4</td>
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<tr>
<td>MIP581A4 -Mosquito Collection and Identification Methods</td>
<td>Fall odd years</td>
<td>1</td>
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<tr>
<td>MIP580A5 -Introduction to Biology of Disease Vectors</td>
<td>Spring even years</td>
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<tr>
<td>MIP580A6 -Biology of Arbovirus Vectors/Genetics</td>
<td>Spring even years</td>
<td>1</td>
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<tr>
<td>MIP580A7 -Biology of Parasite/Bacteria Vectors</td>
<td>Spring even years</td>
<td>1</td>
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<tr>
<td><strong>Molecular and Genomic Approaches Electives</strong></td>
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<tr>
<td>MIP543 -RNA Biology</td>
<td>Fall odd years</td>
<td>3</td>
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<tr>
<td>MIP545 -Microbial Metagenomics/Genomics Data Analysis</td>
<td>Fall</td>
<td>2</td>
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<tr>
<td>MIP565 -Next Generation Sequencing Platform/Libraries</td>
<td>Spring</td>
<td>1</td>
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<tr>
<td>MIP570 -Functional Genomics</td>
<td>Fall</td>
<td>3</td>
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**Immunology Electives**

- MIP581A4 - Flow Cytometry for Immunology  
  - Fall  
- MIP651 - Immunobiology  
  - Fall even years  
- MIP680A4 - Fundamentals of Infectious Disease Immunity  
  - Spring odd years  
- MIP680A5 - Immunity to Viruses  
  - Spring odd years  
- MIP680A6 - Immunity to Bacteria and Parasites  
  - Spring odd years

**Prion Biology Electives**

- MIP520 - Fundamentals of Prion Biology  
  - Fall  
- MIP680A3 - Advanced Prion Biology  
  - Spring

**Pathology Electives**

- MIP615 - Ophthalmic Pathology  
  - Fall even years  
- MIP675 - Advanced Bioanalytic Pathology  
  - Spring odd years  
- MIP765 - Comparative Neuropathology  
  - Spring even years  
- MIP766 - Cytopathology  
  - Spring  
- MIP767 - Advanced General Pathology  
  - Fall  
- MIP768 - Advanced Clinical Pathology  
  - Spring  
- MIP778 - Pathobiology of Laboratory Animals  
  - Fall odd years  
- MIP779 - Laboratory Animal Pathology Rotation  
  - Spring even years

**Courses offered by other CSU Departments**

- BC511 - Structural Biology I  
  - Fall  
- BC611 - Structural Biology II  
  - Spring  
- BC563 - Molecular Genetics  
  - Fall  
- BC565 - Molecular Regulation of Cell Function  
  - Spring  
- BC663 - Gene Expression  
  - Spring  
- BIOM525 - Cell and Tissue Engineering  
  - Spring even years  
- BMS500 - Mammalian Physiology I  
  - Fall  
- BMS501 - Mammalian Physiology II  
  - Spring  
- ERHS510 - Cancer Biology  
  - Spring  
- ERHS611 - Cancer Genetics  
  - Fall  
- CM666 - Science and Ethics  
  - Spring  
- GRAD544 - Ethical Conduct in Research  
  - Fall and Spring  
- GRAD550 - STEM Communication  
  - Fall and Spring  
- NSCI580A2 - Ethical Issues with Big Data  
  - Fall  
- DCSI510 - Linux as a Computational Platform  
  - Fall  
- DCSI511 - Genomics Data Analysis in Python  
  - Fall  
- DCSI512 - RNA-Seq Data Analysis  
  - Fall  
- MATH581 - Linear Algebra for Biologist  
  - Fall  
- STAT511 - Design and Data Analysis for Researchers I  
  - Fall  
- STAT512 - Design and Data Analysis for Researchers II  
  - Spring  
- STAT544 - Biostatistical Methods for Quantitative Data  
  - Spring

More curriculum details and MIP course syllabi are available by request from Heidi Runge.
**IV. Research Teams**

In order to facilitate research conducted by our faculty, development of mentoring skills of our graduate students and research experience for our undergraduate students, MIP has formally implementing a strategy to foster research teams. Research teams are composed of faculty principal investigators (PIs), their students working toward a PhD or MS degree or postdoctoral fellows acting as research mentors (RMs), and students seeking research experience as research trainees (RTs). While we believe that these research teams will greatly advance and enhance our research, mentoring and training opportunities and strongly encourage participation, research team development is completely voluntary.

The research team will be led by a faculty mentor who is acting as a PI on a research project in their laboratory. Research mentors will coordinate with their PIs to identify interested and motivated undergraduate students to join their research team. With consent from their faculty mentor, graduate student RMs can enroll to receive transcripted credit towards their graduate degree for mentoring RTs. Graduate student RMs can also apply these credits toward fulfilling the requirements for the TILT Graduate Teaching Certificate Program.

Research mentors are expected to enroll in a mentoring class for formal instruction on how to mentor a RT. MIP offers MIP780A3- Research Teams Mentoring, a course that teaches graduate students techniques to effectively mentor in a research laboratory setting. It is also expected that research mentors will mentor their RT(s) at least 9 hours per week, including mentor them to present their work to the broader community, such as Celebrate Undergraduate Research and Creativity, Multicultural Undergraduate Research, Leadership and Art Symposium, Science on Tap, or some similar opportunity.

**V. Graduate Student Funding and Assistantships**

**A. International Students**

Due to funding limitations, international applicants often require special consideration. The Department of Microbiology, Immunology & Pathology may not be in a position to fund the expenses of international students. As such, graduate assistantships are typically not offered to international students. Without guaranteed financial support from a government or another organization, serious consideration should be made before applying.

**B. Graduate Assistantships**

Students admitted to the MIP graduate program are awarded Graduate Teaching Assistantships (GTA) during the first year of the program as they preform teaching duties in the undergraduate courses offered by MIP and complete laboratory rotations. By the second year of the program, when a permanent advisor has been identified, students will transition to Graduate Research Assistants (GRA) for the remainder of the program. Both GTA and GRA positions receive a monthly stipend at the current NIH-NRSA pre-doctoral level, and tuition coverage.

**C. Other Funding Opportunities**

The department is committed to funding GTA and GRA students for the duration of their program, but also encourages students to apply for outside funding in the form of fellowships. Students in MIP have a successful track record of fellowship awards including NIH-F31 and NSF-GRFP awards. The department provides a number of resources, including grant writing workshops and courses to aid students in submission of proposals. Information on fellowship opportunities is available on the website.
VI. Student Health Insurance
Health Insurance is a university requirement for all graduate students. Students can either enroll in the university Student Health Insurance Plan or submit a waiver of comparable comprehensive coverage.

A. Graduate Assistantship Health Insurance Contribution
The Graduate School provides a health insurance contribution to help offset the cost of health insurance to graduate assistants who meet the following criteria each fall and/or spring semester: 1.) Appointed to a 25% (10 hours per week) or more assistantship (GTA, GRA), 2.) Enrolled in CSU health insurance, and 3.) Enrolled in five or more resident-instruction credits (Audits, Continuous Registration, and CSU Online credits do not meet the Resident Instruction enrollment criteria for this policy). Students do not need to apply for this benefit. Qualified students are automatically enrolled in the GA Health Insurance Contribution Program. The health insurance contribution will be applied to student accounts and taxed through payroll approximately one week after the end of the regular add/drop period each semester qualified.

VII. Student Involvement Opportunities

A. Graduate Student Organization
The Microbiology Graduate Student Organization (MIP-GSO) is a student organization within the Department of Microbiology, Immunology, and Pathology (MIP); comprised of students from the MS-PhD, Combined DVM/PhD, and Combined Veterinary Residency/PhD program who provide a number of valuable resources for students within the Department. Participation is an excellent opportunity for students to get involved and make a difference within MIP.

MIP-GSO organizes a number of events and programs throughout the year, including:
Professional Development Workshops:
- Career Opportunities, especially focusing on non-academia options
- Teaching/Pedagogy
- Financial Planning
- Professional Networking

Student Invited Speaker:
- Organizing two guest speakers, chosen by the student population, each year to visit campus to give talks and meet with interested students

Student Mentorship Program:
- Pairing incoming students with more senior students to foster valuable relationships

Social and Networking Events:
- FACs (Friday Afternoon Club)
- Hikes in the natural areas surrounding Fort Collins
- Outings to sporting events, such as Colorado Rockies (MLB) and Colorado Eagles (ECHL)
- Intramural sports
- Department-wide March Madness pool
And much more…

B. Student Representation on Graduate Education Committee
The Graduate Education Committee (GEC) is responsible for formulating policy and establishing standards relating to graduate education. They play a major role in recruiting and selecting the
students enrolled in our programs. Two student representatives serve as members on GEC each year. The committee highly values the input and insight that the student representatives provide.