



Department of Microbiology, Immunology and Pathology Combined Veterinary Residency/ 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.

The Combined Veterinary Residency/ Ph.D. program offers Ph.D.-level research in combination with post-DVM residency training in anatomical or clinical pathology, microbiology, and comparative medicine. Completion of this program satisfies the requirements to take the certifying examination of the American College of Veterinary Pathologists, the American College of Microbiologists, and the American College of Laboratory Animal Medicine.

II. Graduate Student and Resident Advisers and the First Years of Study

The Residency Coordinator serves as a temporary graduate 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. The student also has a residency advisor for the duration of the residency portion of the program to guide them through residency training.

The first year of the program is focused on residency training and service requirements. Service requirements begin to reduce in year two and three until the student transitions to PhD work full-time beginning in year 4.

A. Teaching

Residents are expected to teach students in the DVM program lectures, labs, and practicums.

Colorado State University offers a [Graduate Teaching Certificate Program](#). 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 Combined Residency/PhD program will perform informal lab rotations during the first year of study to identify a PhD mentor. The Residency Coordinator and Associate Department Head for Graduate Education will assist students in the selection of research laboratories. Before the start of the third semester of study, a permanent faculty graduate 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 four members for the Ph.D. program, including the graduate research advisor, or 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. 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.

Combined Residency M.S. /Ph.D. Degree Program requirements

Anatomic (AP) and Clinical Pathology (CP) Residency/Graduate Program

Anatomic and Clinical Pathology Residents: required courses

MIP792A-Seminar-Research/Graduate, 1 credit each semester

MIP792C-Seminar- Microscopic and Bioanalytic Pathology, 1 credit seminar every semester (AP/CP-minimum of 6 credits)

MIP 654-Research Policies and Regulations, 1 credit

or GRAD544-Ethical Conduct in Research, 1 credit

or NSCI580A2/NSCI575/GRAD575- Ethical Issues in Big Data Research, 1 credit

MIP700- Topics in Microbiology or approved substitutions, (MS- 2 semesters, PhD- 4 semesters)

Approved substitutions:

MIP796-010 Group Study-Gross Pathology

MIP796-003 Group Study-Bioanalytic Pathology

MIP796-005 Group Study-Contemporary Topics in Comparative Medicine

MIP796-002 Group Study-Surgical Pathology

Recommended courses:

MIP540-Biosafety in Research Laboratories, 2 credits

MIP643-Grant Writing, 1 credit

MIP651-Immunobiology, 3 credits

MIP675- Advanced Bioanalytic Pathology, 3 credits

MIP765 -Comparative Neuropathology, 2 credits

MIP766-Cytopathology, 1 credit

MIP767-Advanced General Pathology, 1credit

MIP768-Advanced Clinical Pathology, 1 credit

MIP778-Pathobiology of Laboratory Animals, 3 credits

MIP779-Laboratory Animal Pathology Rotation, 1 credit

MIP796-003- Group Study- Clinical Pathology, 1 credit

CM501-Advanced Cell Biology

or BC565-Molecular Regulation of Cell Function, 4 credits

VS562-Applied Data Analysis, 3 credits

or STAR511/512- Design and Data Analysis for Researchers I and II, 4 credits

Comparative Medicine Residency/Graduate Program

MIP792A-Seminar-Research/Graduate, (1 credit/semester)

MIP796-005-Contemporary Topics in Comparative Medicine (1 credit/semester, 1 semester/year as offered) 3 years

MIP540-Biosafety in Research Laboratories, 2 credits

MIP778-Pathobiology of Laboratory Animals, 3 credits

MIP779-Laboratory Animal Pathology Rotation, 1 credit (previously offered as MIP795)

GRAD544- Ethical Conduct of Research, 1 credit

Highly recommended courses:

BC463-Molecular Genetics

MIP542-Pillars of Immunology

MIP666-Writing Scientific Manuscript, 3 credits

MIP767-Advanced General Pathology

Biostatistics courses: One of the following:

STAR511A/512-Design and Data Analysis for Research Scientists

Microbiology Residency/Graduate Program

MIP792A-Seminar-Research/Graduate, 1 credit each semester

MIP654-Research Policies and Regulations, 1 credit

or GRAD544-Ethical conduct in Research, 1 credit

or NSCI580A2/NSCI575/GRAD575- Ethical Issues in Big Data Research, 1 credit

MIP700- Topics in Microbiology, 1 credit each semester (MS- 2 semesters, PhD- 4 semesters)

Highly suggested courses or course topics:

MIP540- Biosafety in Research Laboratories, 2 credits

MIP581A5-Advanced Virology: Fundamentals/New Insights, 1 credit

MIP581A6-Advanced Virology: Mechanisms of Viral Disease, 1 credit

MIP581A7-Advanced Virology: Discovery Tools and Control, 1 credit

MIP651- Immunobiology, 3 credits

MIP573A- Bacterial Pathogenesis: Introduction to Mechanisms, 1 credit

MIP573B-Bacterial Pathogenesis: Mechanisms of Lifestyle, 1 credit

MIP573C-Bacterial Pathogenesis: Evading Host Defenses, 1 credit

Statistics (appropriate course as determined by graduate committee)

Combined Residency/PhD average time to completion is 6.5 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 8th semester in the combined residency-graduate program (Spring of the 4th year).

C. 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 in the Residency program are required to present a seminar every other academic year during their graduate studies, beginning the year following the completion of residency. Final defense seminars may be presented as part of the weekly graduate seminar series or separately.

D. MIP Graduate Curriculum - PhD Programs

PhD Credit Requirements

72 credits total

24 credits at CSU (30 credits can be applied from MS or DVM degree)

21 credits must be 500+ (beyond MS/DVM if applicable)

16 credits must be regular courses*

13 credits must be regular courses* with MIP prefix

*Regular course work is defined as courses other than seminars, topics, independent or group studies, research credits, thesis/dissertation credits, and supervised college teaching.

| <i>Course Number and Title</i> | <i>Offered</i> | <i>Credits</i> |
|--------------------------------|----------------|----------------|
|--------------------------------|----------------|----------------|

Required Courses

| | | |
|--|-----------------|---|
| MIP700 -Topics in Microbiology, Immunology and Pathology | Fall and Spring | 1 |
| MIP792A - Graduate Student Seminar | Fall and Spring | 1 |
| MIP654 - Research Policies and Regulations | Spring | 1 |

General Electives

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|--|-----------------|---|
| MIP470 -Graduate Fellowship Proposal Preparation | Fall | 1 |
| MIP540 -Biosafety in Research Laboratories | Spring | 2 |
| MIP643 -Grant Writing for Microbiology/Pathology | Fall and Spring | 1 |
| MIP666 -Writing Scientific Manuscripts | Fall | 3 |
| MIP710 –Research Teams Mentoring | Spring | 1 |

Virology Electives

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|---|-------------------|---|
| MIP533 -Epidemiology of Infectious Disease | Spring | 3 |
| MIP543 -RNA Biology | Fall odd years | 3 |
| MIP581A5 -Advanced Virology - Fundamentals/New Insights | Spring even years | 1 |
| MIP581A6 -Advanced Virology - Mechanisms of Viral Disease | Spring even years | 1 |
| MIP581A7 -Advanced Virology - Discovery Tools and Control | Spring even years | 1 |
| MIP680A4 -Fundamentals of Infectious Disease Immunity | Spring odd years | 1 |
| MIP680A5 –Immunity to Viruses | Spring odd years | 1 |

Bacteriology Electives

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|--|----------------|---|
| MIP550 -Microbial and Molecular Genetics Laboratory | Spring | 4 |
| MIP573A -Intro to Mechanisms of Bacterial Pathogenesis | Fall odd years | 1 |
| MIP573B -Bacterial Pathogenesis Mechanisms & Lifestyle | Fall odd years | 1 |
| MIP573C -Bacterial Pathogenesis –Evading Host Defenses | Fall odd years | 1 |

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|---|------------------|---|
| MIP680A4 -Fundamentals of Infectious Disease Immunity | Spring odd years | 1 |
| MIP680A6 -Immunity to Bacteria and Parasites | Spring odd years | 1 |
| MIP681A5 -Introduction to Advanced Microbial Physiology | Fall even years | 1 |
| MIP681A6 -Advanced Microbial Physiology Experimentation | Fall even years | 1 |
| MIP681A7 -Microbial Physiology –Translational Discover | Fall even years | 1 |

Vector Biology Electives

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|--|-------------------|---|
| MIP535 -Mosquito Collection and Identification Methods | Fall odd years | 1 |
| MIP580A5 -Introduction to Biology of Disease Vectors | Spring even years | 1 |
| MIP580A6 -Biology of Arbovirus Vectors/Genetics | Spring even years | 1 |
| MIP580A7 -Biology of Parasite/Bacteria Vectors | Spring even years | 1 |

Molecular and Genomic Approaches Electives

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|---|----------------|---|
| MIP543 -RNA Biology | Fall odd years | 3 |
| MIP545 -Microbial Metagenomics/Genomics Data Analysis | Fall | 2 |
| MIP565 -Next Generation Sequencing Platform/Libraries | Spring | 1 |
| MIP570 -Functional Genomics | Fall | 3 |

Immunology Electives

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|---|-------------------|---|
| MIP525 -Flow Cytometry for Immunology | Fall | 1 |
| MIP651 -Immunobiology | Fall even years | 3 |
| MIP730 -Principles of Flow Cytometry & Cell Sorting | Spring | 2 |
| MIP542 -Pillars of Immunology | Fall odd years | 1 |
| MIP680A4 -Fundamentals of Infectious Disease Immunity | Spring odd years | 1 |
| MIP680A5 –Immunity to Viruses | Spring odd years | 1 |
| MIP680A6 -Immunity to Bacteria and Parasites | Spring odd years | 1 |
| MIP681A4 -B Cells Development and Function | Spring even years | 1 |

Pathology Electives

| | | |
|--|-------------------|---|
| MIP675 -Advanced Bioanalytic Pathology | Spring odd years | 2 |
| MIP765 -Comparative Neuropathology | Spring even years | 2 |
| MIP766 -Cytopathology | Spring | 1 |
| MIP767 -Advanced General Pathology | Fall | 1 |
| MIP768 -Advanced Clinical Pathology | Spring | 1 |
| MIP778 -Pathobiology of Laboratory Animals | Fall odd years | 3 |
| MIP779 -Laboratory Animal Pathology Rotation | Spring even years | 1 |

Courses offered by other CSU Departments

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|---|-------------------|---|---|
| BC563 -Molecular Genetics | Fall | 4 | 2 |
| BC565 -Molecular Regulation of Cell Function | Spring | 4 | |
| BIOM525 -Cell and Tissue Engineering | Spring even years | 3 | |
| BMS500 -Mammalian Physiology I | Fall | 4 | |
| BMS501 -Mammalian Physiology II | Spring | 4 | |
| ERHS510 -Cancer Biology | Spring | 3 | |
| ERHS535 -R Programming Research | Fall | 3 | |
| ERHS611 -Cancer Genetics | Fall | 2 | |
| GRAD544 -Ethical Conduct in Research | Fall and Spring | 1 | |
| GRAD550 -STEM Communication | Fall and Spring | 1 | |
| NSCI575/GRAD575 -Ethical Issues with Big Data | Spring | 1 | |
| DCSI510 -Linux as a Computational Platform | Fall | 1 | |
| DCSI511 -Genomics Data Analysis in Python | Fall | 2 | |
| DCSI512 -RNA-Seq Data Analysis | Fall | 1 | |

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|--|--------|---|
| STAR511 -Design and Data Analysis for Researchers I | Fall | 4 |
| STAR512 -Design and Data Analysis for Researchers II | Spring | 4 |

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 implemented 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 MIP710- 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 Appointments

Students admitted to the Combined Residency/PhD Program are appointed as Postdoctoral Fellows and are benefit eligible employees. Information on benefits packages can be found on the [HR website](#). The program covers tuition, however students are responsible for some student fees (~\$200/semester).

VII. Student Involvement Opportunities

A. Graduate Student Organization

The [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 several 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.