

MAJOR IN MEDICAL MICROBIOLOGY AND INFECTIOUS DISEASE

Microbiology is the study of organisms, many of which are too small to be seen with the naked eye, including fungi, protists, and bacteria, as well as acellular agents such as viruses and prions. Microbiology emerged as a distinct science in the late nineteenth century, with the discovery that microorganisms are the cause of many infectious diseases, and that they play essential roles in ecosystems (such as the microbiome) and in industrial processes. Much work in this field is directed toward the cure, control, or eradication of disease in humans and animals, as well as understanding how microbes support health and life. Genetically engineered microorganisms can also be used for the production of improved foods, new drugs and vaccines, and for removing toxic wastes and spills from the environment. Unfortunately, some microbes have received considerable attention as potential agents of bioterrorism and biowarfare, and consequently much work is being done to counter such threats.

Students completing the undergraduate Microbiology major acquire knowledge and laboratory skills in the structure, physiology, genetics, pathogenicity, ecology, and taxonomy of microorganisms, as well as immunological techniques. Students engage in authentic hypothesis-driven research problems in inquiry-based laboratory courses. Required courses in biological sciences, chemistry, physics, and mathematics support the major. Ample opportunities exist for undergraduates to obtain laboratory research experience and many student researchers have presented at conferences and have been awarded research grants or fellowships.

A Bachelor of Science degree in Medical Microbiology & Infectious Disease prepares graduates well for continued education in a professional or graduate degree program or for employment in the field.

Learning Objectives

Upon successful completion of this major, students will be able to:

1. Demonstrate comprehensive knowledge of microbial biology and diversity, explaining the structure, function, genetics, metabolism, and diversity of microorganisms (bacteria, viruses, fungi, parasites) and their roles in health, disease, and biotechnology.
2. Explain host–pathogen interactions and mechanisms of infectious disease, describing how pathogens adhere, invade, replicate, produce toxins, and evade host defenses, and how these processes relate to clinical disease.
3. Apply principles of immunology to understand defense against infection, explaining innate and adaptive immune components, their roles in recognizing and eliminating pathogens, and how immune dysfunction contributes to infectious and immune-mediated disease.
4. Perform laboratory techniques for microbial identification and analysis, demonstrating proficiency in aseptic technique, cultivation, staining, microscopy, biochemical and serological assays, molecular/diagnostic methods, and safe handling of infectious agents.
5. Analyze and interpret microbiological and immunological data, designing or evaluating experiments, applying appropriate quantitative/statistical methods, interpreting assay results, and critically evaluating primary literature in microbiology and infectious diseases.
6. Describe the transmission, prevention, and control of infectious diseases, explaining major routes of transmission, basic outbreak/infection concepts, and strategies such as vaccines, antimicrobials, infection control, and antimicrobial stewardship.
7. Communicate microbiological concepts and research findings effectively, producing clear written reports, oral presentations, and visual materials tailored to scientific, clinical, and lay audiences.
8. Apply ethical reasoning and biosafety principles in microbiology practice, following biosafety protocols, regulatory and ethical guidelines (including equity and social determinants of health), and demonstrating professionalism and responsible conduct.

Requirements Effective Fall 2026

Freshman

		AUCC	Credits
CHEM 111	General Chemistry I (GT-SC2)	3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	3A	1
CHEM 113	General Chemistry II		3
CHEM 114	General Chemistry Lab II		1
CO 150	College Composition (GT-CO2)	1A	3
LIFE 102	Attributes of Living Systems (GT-SC1)	3A	4
MIP 260	The World of Parasites		3
VMBS 100	Introduction to Biomedical Sciences Major		2
Select a minimum of 3 credits from the following:			3
MATH 118	College Algebra in Context II (GT-MA1)	1B	
MATH 124	Logarithmic and Exponential Functions (GT-MA1)	1B	
MATH 125	Numerical Trigonometry (GT-MA1)	1B	
MATH 126	Analytic Trigonometry (GT-MA1)	1B	
MATH 155	Calculus for Biological Scientists I (GT-MA1)	1B	

MATH 160	Calculus for Physical Scientists I (GT-MA1)	1B	
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
Elective			3
Total Credits			30
Sophomore			
BC 351	Principles of Biochemistry		4
MIP 250	Eukaryotic Microbiology		3
MIP 300	General Microbiology		3
MIP 302	General Microbiology Laboratory		2
MIP 342	Immunology		4
Select one group from the following:			8
Group A			
CHEM 245	Fundamentals of Organic Chemistry		
CHEM 246	Fundamentals of Organic Chemistry Laboratory		
Concentration Electives (see list below)			
Group B			
CHEM 341	Modern Organic Chemistry I		
CHEM 343 ¹	Modern Organic Chemistry II		
CHEM 344	Modern Organic Chemistry Laboratory		
Select one course from the following:			1-2
MIP 292	Early Career Preparation in Microbiology		
MIP 372	Graduate School Preparation for Microbiology		
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		3C	3
Total Credits			31-32
Junior			
MIP 443	Microbial Physiology		3
MIP 450	Microbial Genetics		3
Select one course from the following:			5
PH 121	General Physics I (GT-SC1)	3A	
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	
Select one course from the following:			4
BMS 300	Principles of Human Physiology		
BMS 360	Fundamentals of Physiology		
Concentration Electives (See list below)			
Advanced Writing (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)		2	3
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
Elective			3
Total Credits			29
Senior			
MIP 351	Medical Bacteriology	4B	3
MIP 420	Medical and Molecular Virology	4A	4
Select one course from the following:			2
MIP 400A	Capstone in Microbiology: Medical Microbiology	4C	
MIP 400B	Capstone in Microbiology: Biotechnology	4C	
MIP 400C	Capstone in Microbiology: Immunology	4C	

MIP 498	Research	4C	
Select one course from the following:			3
STAT 301	Introduction to Applied Statistical Methods		
STAT 307	Introduction to Biostatistics		
Concentration Electives (See list below)			9
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/ #arts-humanities)			3
Electives ²			5-6
Total Credits			29-30
Program Total Credits:			120

Concentration Electives

Code Title Credits

Select a minimum of 17 credits from the following not taken elsewhere in the program. CHEM 343 may count as a Concentration Elective for students who select organic chemistry Group B in the Sophomore year.

A minimum of two laboratory courses MUST be selected from the following:

MIP 150	CURE - Introduction to Microbiology Research	
MIP 270	CURE-Microbial Sequence Research	
MIP 335	Food Microbiology Laboratory	
MIP 343	Immunology Laboratory	
MIP 352	Medical Bacteriology Laboratory	
MIP 355	CURE – Phage Discovery and Genetics	
MIP 401	CURE – Advanced Research in Microbiology	
MIP 425	Virology and Cell Culture Laboratory	
MIP 433/ESS 433	Microbial Ecology Laboratory	
MIP 462/ BSPM 462/BZ 462	Parasitology and Vector Biology	
MIP 550	Microbial and Molecular Genetics Laboratory	

Two unique courses (for a maximum of 6 credits) may be selected from the following:

MIP 298	Introductory Research	
MIP 384	Supervised College Teaching	
MIP 495	Independent Study	
MIP 498	Research	
ANEQ 460	Meat Safety	2
BC 404	Comprehensive Biochemistry Laboratory	2
BC 463	Molecular Genetics	3
BMS 301	Human Gross Anatomy	5
BMS 302	Laboratory in Principles of Physiology	2
BMS 305	Domestic Animal Gross Anatomy	4
BMS 325	Cellular Neurobiology	3
BMS 330	Microscopic Anatomy	4
BMS 345	Functional Neuroanatomy	4
BMS 401	Laboratory Research in Biomedical Sciences	4
BMS 420	Cardiopulmonary Physiology	3
BMS 450	Pharmacology	3
BMS 460	Essentials of Pathophysiology	3

BSPM 302	Applied and General Entomology	2
BSPM 361	Elements of Plant Pathology	3
BZ 220	Introduction to Evolution	3
BZ 310	Cell Biology	4
BZ 333	Introductory Mycology	4
BZ 350	Molecular and General Genetics	4
BZ 360	Bioinformatics and Genomics	4
BZ 418	Ecology of Infectious Diseases	4
CHEM 343	Modern Organic Chemistry II ¹	3
ERHS 210	Cancer Biology, Medicine, and Society	3
ERHS 220	Introduction to Environmental Public Health	3
ERHS 320	Environmental Health-Water Quality	3
ERHS 332	Principles of Epidemiology	3
ERHS 350	Principles of Occupational Safety and Health	3
ERHS 410	Environmental Health-Air and Waste Management	3
ERHS 430	Human Disease and the Environment	3
ERHS 446	Environmental Toxicology	3
ERHS 448	Environmental Contaminants	3
ERHS 502	Fundamentals of Toxicology	3
ERHS 567	Cell and Molecular Toxicology Techniques	3
FTEC 360	Brewing Processes	4
FTEC 460	Brewing Science II	5
FTEC 574	Current Issues in Food Safety	2
LIFE 103	Biology of Organisms-Animals and Plants	4
LIFE 201B	Introductory Genetics: Molecular/Immunological/Developmental (GT-SC2)	3
LIFE 203	Introductory Genetics Laboratory	2
LIFE 210	Introductory Eukaryotic Cell Biology	3
LIFE 211	Introductory Cell Biology Honors Recitation	1
LIFE 212	Introductory Cell Biology Laboratory	2
LIFE 320	Ecology	3
MATH 155	Calculus for Biological Scientists I (GT-MA1)	4
MATH 160	Calculus for Physical Scientists I (GT-MA1)	4
MIP 303	General Microbiology-Honors Recitation	1
MIP 315	Pathology of Human and Animal Disease	3
MIP 334	Food Microbiology	3
MIP 400A	Capstone in Microbiology: Medical Microbiology	2

MIP 400B	Capstone in Microbiology: Biotechnology	2
MIP 400C	Capstone in Microbiology: Immunology	2
MIP 410	Foundations of Modern Biotechnology	2
MIP 432/ESS 432	Microbial Ecology	3
MIP 443	Microbial Physiology	3
MIP 450	Microbial Genetics	3
MIP 496	Group Study	1-3
MIP 540	Fundamentals of Biosafety and Biosecurity	2
MIP 551	Infectious Diseases and Social Equity	3
MIP 552	Social Impacts of Biomedical Research	3
MIP 553	Health Communication for Infectious Diseases	3
MIP 555	Principles and Mechanisms of Disease	3
MIP 570	Functional Genomics	3
OT 215	Medical Terminology	1
PH 122	General Physics II (GT-SC1)	5
SOCR 330	Principles of Genetics	3
SOCR 455	Microbiomes of Soil Systems	3
VS 331	Histology	4
VS 333	Domestic Animal Anatomy	4

¹ CHEM 343 may count as a Concentration Elective for students who select organic chemistry Group B in the Sophomore year.

² Select enough elective credits to bring the program total to a minimum of 120 credits, of which at least 42 must be upper-division (300- to 400-level).

Major Completion Map

Distinctive Requirements for Degree Program:

To Declare Major: competitive entry controls required and capped enrollment in place. Please contact Director of Student Success in the CVMBS Student Success Center for more information.

To prepare for first semester: The curriculum for the Medical Microbiology and Infectious Disease major assumes students enter college prepared to take MATH 124. Entering students who are not prepared to take MATH 124 will need to prerequisite requirements in the first semester. Those requirements are listed as benchmark courses in Freshman Semester 1 below. LIFE 102 requires high school chemistry as a prerequisite; CHEM 111 requires Algebra II as a prerequisite (this prerequisite is met by having Algebra II by test credit, transfer credit, or placement out of MATH 117 and MATH 118 on Math Placement Exam).

Freshman

Semester 1		Critical	Recommended	AUCC	Credits
CHEM 111	General Chemistry I (GT-SC2)	X		3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	X		3A	1
CO 150	College Composition (GT-CO2)			1A	3
VMBS 100	Introduction to Biomedical Sciences Major				2
Select a minimum of 3 credits from the following:					3
MATH 118	College Algebra in Context II (GT-MA1)			1B	
MATH 124	Logarithmic and Exponential Functions (GT-MA1)		X	1B	
MATH 125	Numerical Trigonometry (GT-MA1)			1B	
MATH 126	Analytic Trigonometry (GT-MA1)			1B	
MATH 155	Calculus for Biological Scientists I (GT-MA1)			1B	
MATH 160	Calculus for Physical Scientists I (GT-MA1)			1B	
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)				1C	3
MATH 124 must be completed by the end of Semester 1, if necessary.		X			

Total Credits

16

Semester 2		Critical	Recommended	AUCC	Credits
CHEM 113	General Chemistry II	X			3
CHEM 114	General Chemistry Lab II	X			1
LIFE 102	Attributes of Living Systems (GT-SC1)	X		3A	4
MIP 260	The World of Parasites	X			3
Elective					3
3 credits of AUCC 3B must be completed by the end of semester 2.		X			

Total Credits

14

Sophomore

Semester 3		Critical	Recommended	AUCC	Credits
MIP 250	Eukaryotic Microbiology	X			3
MIP 300	General Microbiology	X			3
MIP 302	General Microbiology Laboratory	X			2
Select one group from the following:					3-5

Group A: (5 credits)

CHEM 245	Fundamentals of Organic Chemistry	X
CHEM 246	Fundamentals of Organic Chemistry Laboratory	X

Group B: (3 credits)

CHEM 341	Modern Organic Chemistry I
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Social and Behavioral Sciences (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)	3C	3
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Total Credits		14-16
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Semester 4	Critical	Recommended	AUCC	Credits
BC 351 Principles of Biochemistry		X		4
MIP 342 Immunology	X			4
Select the same Group (A or B) as selected Semester 3:				3-5

Group A: (3 credits)

Concentration Electives (See list on Requirements Tab)

Group B: (5 credits)

CHEM 343	Modern Organic Chemistry II
CHEM 344	Modern Organic Chemistry Laboratory

Select one course from the following:	X			1-2
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MIP 292	Early Career Preparation in Microbiology
MIP 372	Graduate School Preparation for Microbiology

Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)			3D	3
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Select MIP 292 in semester 4 if MIP 372 is not taken in semester 5

Total Credits		15-18
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Junior

Semester 5	Critical	Recommended	AUCC	Credits
MIP 450 Microbial Genetics		X		3
Select one course from the following:				5

PH 121	General Physics I (GT-SC1)	X	3A
PH 141	Physics for Scientists and Engineers I (GT-SC1)		3A

Concentration Electives (See list on Requirements Tab)				5
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Select MIP 372 in semester 5 if MIP 292 is not taken in Semester 4

Total Credits		13
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Semester 6	Critical	Recommended	AUCC	Credits
MIP 443 Microbial Physiology				3
Select one course from the following:				4

BMS 300	Principles of Human Physiology
BMS 360	Fundamentals of Physiology

Advanced Writing (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)			2	3
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Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)			3B	3
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Elective				3
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Total Credits		16
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Senior

Semester 7	Critical	Recommended	AUCC	Credits
MIP 420 Medical and Molecular Virology	X		4A	4
Select one AUCC 4C course from the following:	X		4C	2

MIP 400A	Capstone in Microbiology: Medical Microbiology	4C
MIP 400B	Capstone in Microbiology: Biotechnology	4C
MIP 400C	Capstone in Microbiology: Immunology	4C
MIP 498	Research	4C

Select one from the following:				3
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STAT 301	Introduction to Applied Statistical Methods				
STAT 307	Introduction to Biostatistics				
Concentration Elective (See list on Requirements Tab)					3
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)					3
Total Credits					15
Semester 8		Critical	Recommended	AUCC	Credits
MIP 351	Medical Bacteriology	X		4B	3
Concentration Electives (See list on Requirements Tab)		X			6
Electives		X			5-6
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.		X			
Total Credits					14-15
Program Total Credits:					120