

College of Veterinary Medicine and Biomedical Sciences

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Professor Lance Perryman, Dean

*Professor Kenneth Blehm, Associate Dean for
Undergraduate Education*

*Professor Peter W. Hellyer, Associate Dean for
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*Professor Torrance Nett, Associate Dean for Graduate
Education and Research*

*Associate Professor Sherry Stewart, Assistant Dean for
PVM Admissions and Student Affairs*

UNDERGRADUATE MAJORS

Biomedical Sciences

Environmental Health

Microbiology

UNDERGRADUATE MINORS

Biomedical Sciences

Microbiology

COLLEGE PROGRAMS

Doctor of Veterinary Medicine

A concern for health and the diseases of animals and humans provides the unifying theme for the undergraduate, professional, and graduate programs of the College of Veterinary Medicine and Biomedical Sciences. The College combines teaching, research, and public service activities in basic biomedical disciplines such as anatomy, neurobiology, physiology, microbiology, pathology, and radiological health sciences, with applied disciplines such as clinical veterinary medicine and surgery, diagnostic imaging, radiology, clinical laboratory sciences, epidemiology, and environmental health sciences. Graduates of the College in either the veterinary sciences or the biomedical sciences serve society in the broadest sense – they represent the concept that there is but “one medicine” with human and animal health intimately interrelated.

Major Courses of Study

The College of Veterinary Medicine and Biomedical Sciences offers undergraduate, professional, and graduate courses of study. There are three undergraduate programs leading to the Bachelor of Science with majors in biomedical sciences, environmental health, and microbiology. The Bachelor of Science degree requires a minimum of 120 credits with a minimum of 42 in upper-division courses. The four-year professional veterinary medical program leads to the Doctor of Veterinary Medicine degree; students in this program typically complete a baccalaureate degree as part of their preparation. Graduate studies in each of the four departments of the college lead to Master of Science and Doctor of Philosophy degrees.

Study Abroad

Study abroad programs are available to students in the College of Veterinary Medicine and Biomedical Sciences. Because the knowledge of at least one other culture is valuable in understanding our own, students are strongly encouraged to take a semester or longer to study outside the United States as part of their overall program. Students interested in study abroad should plan far in advance by discussing opportunities with their academic adviser and by visiting the Office of International Programs in Laurel Hall, www.studyabroad.colostate.edu.

Continuing Education

The College of Veterinary Medicine and Biomedical Sciences supports the veterinary profession by offering continuing education courses that enable practicing veterinarians to obtain new medical information and meet the Colorado Veterinary Practice Act’s continuing education requirements for re-licensure. The College shares responsibility for continuing education and maintains close liaison with the American Veterinary Medical Association (AVMA), the Colorado Veterinary Medical Association (CVMA), the Colorado Board of Veterinary Medicine, and the Western Interstate Commission for Higher Education (WICHE).

Graduate Programs

Programs leading to the Master of Science and Doctor of Philosophy degrees are offered in all departments of the College.

Students with Bachelor of Science or Doctor of Veterinary Medicine degrees or well-qualified students who are currently pursuing veterinary medicine degrees, are eligible to study for advanced degrees in the Departments of Biomedical Sciences; Clinical Sciences; Environmental and Radiological Health Sciences; and Microbiology, Immunology, and Pathology.

The College of Veterinary Medicine and Biomedical Sciences (CVMBMS) and the College of Business have created a combined five-year program of study that can result in earning both the master of business administration degree and Doctor of Veterinary Medicine degree. Applicants to the Professional Veterinary Medical (PVM) program are encouraged to consider extending their veterinary education to include a one-year start to an M.B.A. degree. After successfully completing the first year of the M.B.A. program, students will be guaranteed admission to the first year of the PVM program and will be expected to complete the remaining M.B.A. course requirements concurrently with the first two years of the PVM curriculum. A recent national study of the veterinary profession indicated that traditional scientific skills and knowledge might not be sufficient to capitalize on future economic opportunities. This program was undertaken to improve training of our students in veterinary practice management and business skills.

There is a national need for veterinarians who can serve as the bridge between research and all aspects of animal health and welfare. The College has developed a 7-year DVM/PhD program that will integrate the PVM and PhD training regimens to provide a dual degree to selected candidates. Numerous outstanding research opportunities exist in diverse areas: cancer biology, infectious disease, neurosciences, reproductive biology, epidemiology, orthopedic sciences, environmental health, and toxicology to complement the DVM training program. The typical DVM/PhD program would be basic graduate study and laboratory rotations (year 1); first two years of PVM training plus electives and graduate work (years 2 and 3); exclusive research work in the PhD program (years 4 and 5); and completion of the PVM training (years 6 and 7).

For detailed information about graduate programs, refer to the individual departments or write to the department concerned. See also the *Graduate and Professional Bulletin*, <http://graduateschool.colostate.edu/index.asp?url=catalog>.

INTERDEPARTMENTAL PROGRAM

Doctor of Veterinary Medicine

A four-year professional program in veterinary medicine (Professional Veterinary Medicine or PVM) is offered annually to approximately 134 students. Because the number of applicants exceeds the number of students who can be admitted to any class, the Admissions Committee for the College of Veterinary Medicine and Biomedical Sciences carefully evaluate each applicant to recommend those best qualified. Information concerning the academic program which leads to the Doctor of Veterinary Medicine (D.V.M.) degree may be found in the *Graduate and Professional Bulletin* or at www.cvmbms.colostate.edu/cvmbms/prospectiveprevet.htm. The full course of study requires four years beyond completion of the pre-veterinary requirements. While exceptional students may complete pre-veterinary requirements in two to three years and then be accepted into the Professional Veterinary Medicine Program; it is much more common that students complete a baccalaureate degree followed by four years in the professional program.

Pre-Veterinary Training for the Professional Veterinary Medicine Program

Students may take their preprofessional (pre-veterinary) training at any accredited institution whether these courses are part of a regularly offered baccalaureate program or whether the courses are taken as “stand alone” choices independent of a degree program.

However, courses must be substantially equivalent in subject content and level as offered for pre-veterinary students at Colorado State.

Inquiries regarding equivalent or substitute courses that may be taken SPECIFICALLY to meet pre-veterinary preparation requirements should be directed to the Office of the Dean, Assistant Dean for Admissions, Professional Veterinary Medicine, Campus Delivery 1601, Fort Collins, CO 80523-1601.

While Colorado State students meeting the pre-veterinary requirements as an integral part of a degree program will take a higher number of credits, the minimum course requirements for admission to the Professional Veterinary Medicine program, exclusive of electives, are:

Arts, Humanities, Behavioral and Social Sciences – at least 12 semester credits. (Agricultural or business courses and the required credits for English composition do not fulfill these requirements.)

Biological Sciences – at least three semester credits in genetics and a laboratory associated with a biological science course.

Chemistry – at least three semester credits in biochemistry (requiring organic chemistry as a prerequisite) and a laboratory associated with a chemistry course.

English Composition – at least three semester credits.

Physics – at least four semester credits with laboratory.

Statistics – at least three semester credits (upper-division course preferred).

Additional courses that are not required, but highly recommended, are anatomy, cell biology, developmental biology, histology, microbiology, nutrition, physiology, and computer science. These courses will enhance the student's preparation for the Professional Veterinary Medicine program.

The pre-veterinary requirement includes the previous categories and credits plus additional credits to total 60 semester credits that must be completed prior to admission to the Professional Veterinary Medicine program. The clear majority of students will complete the pre-veterinary requirements as part of a baccalaureate program that is finished prior to the start of the professional veterinary medicine program. Exceptional students may apply for admission to the Professional Veterinary Medicine program when only the pre-veterinary requirements are met; however, the number of such students competitively admitted is a very small part of each class.

Students who wish to pursue pre-professional veterinary medicine training (sufficient to meet minimum requirements to apply to the Colorado State Professional Veterinary Medicine Program) through courses offered at Colorado State as part of their undergraduate degree program will find detailed information at: www.cvmb.colostate.edu/cvmb/PreprofessionalCourses.htm.

Food Animal Veterinary Career Incentive Program

There are many vacancies and numerous career opportunities in all sectors of private food animal practice including mixed animal practice, and specialty practices in dairy cattle, beef cow-calf, beef feedlots, sheep, and swine. There are also many opportunities in public practice including food safety and inspection, communicable disease

management, and regulatory veterinary medicine. Many practitioners and producers have found it difficult to recruit new graduates into food and fiber animal practice, especially in rural communities. Reduced veterinary participation in food and fiber production animal medicine may contribute to increased vulnerability of livestock industries to emerging infectious diseases, exotic and zoonotic diseases, public health risks from food safety and quality problems, lowered public confidence in animal agricultural products as well as threats to the national economy. Thus, the overarching goal of the Food Animal Veterinary Career Incentive Program (FAVCIP) is to create a sustainable source of future veterinarians for underserved disciplines and geographic regions central to the future of safe and successful food and fiber animal production. This program includes a plan of academic work, experience, and mentoring that encompasses undergraduate and veterinary medical education and meets specific needs of animal agriculture through a cooperative venture of the College of Veterinary Medicine and Biomedical Sciences and the Department of Animal Sciences in the College of Agricultural Sciences. Additional options to proceed to veterinary school focusing on food and fiber animal production are described within the FAVCIP literature.

Undergraduate students with a strong interest in pursuing veterinary careers in a food animal discipline will be encouraged to follow the FAVCIP curriculum and program requirements as they complete their Bachelor of Science in animal science at Colorado State University (see www.cvmb.colostate.edu/cvmb/FoodAnimalVetCareerIncentiveProgram.pdf).

DEPARTMENT OF BIOMEDICAL SCIENCES

Office in Physiology Building, Room 102
www.cvmb.colostate.edu/bms

Professor Barbara Sanborn, Head

Major in Biomedical Sciences

An undergraduate degree in biomedical sciences prepares students for a wide variety of opportunities which have a basis in cellular and molecular biology, human/animal anatomy and physiology. Students will have opportunities to engage in coursework and laboratory work if warranted which concentrate on specialty areas in endocrinology, pharmacology, neurophysiology, reproductive physiology, and

cardiopulmonary physiology. The curriculum will prepare graduates for admission to medical or veterinary schools, schools of physical therapy and physician assistant programs, optometry, pharmacy, and dentistry. The program will also prepare students for graduate studies in the biomedical sciences as well as for employment in a variety of innovative and developing fields in biotechnology.

The basic science curriculum meets requirements for entrance into professional schools. The curriculum permits students to select university offered and major-related electives which fit with the educational objectives of students. Experiential learning opportunities consisting of laboratory research experiences, teaching experiences in selected courses, and internships with biotechnology firms (primarily summer) will be available for students seeking such opportunities. These opportunities will be designed with the student's career goals as the focus.

Learning Outcomes

Students will:

- Obtain a solid background in anatomy and physiology and be able to integrate knowledge from the molecular to the systemic level
- Demonstrate strong writing and oral communication skills
- Develop scientific hypotheses and experiments to test them;
- Work effectively in groups
- Demonstrate effective organization, leadership, and laboratory skills
- Think critically and logically

Potential Occupations

A Bachelor of Science degree in biomedical sciences will provide students with many opportunities for further study or employment in the broad area of biomedical sciences. The coursework is designed to prepare students for health-related graduate and professional programs. Post-graduate opportunities will include additional studies in specialty areas of physiology such as neuroscience, reproductive endocrinology, cardiopulmonary and pathophysiology. Employment opportunities can be found in government at the local, state, and national levels; research in a variety of settings such as university, industry, and private laboratories; education; administration and management; and industry such as biotechnology, pharmaceuticals, and medical devices. Students will be exposed to skill sets which are necessary in a competitive, ever changing job market.

MATH 117, MATH 118, MATH 124, MATH 125, MATH 126, M CC 120A-B, and M CC 121 are considered review courses. Credits in these courses do not count in the 120 credit program of study for the major in biomedical sciences.

Course	Title	Cr	AUCC
FRESHMAN			
CHEM 111 ^P	General Chemistry I	4	3A
CHEM 112 ^P	General Chemistry Laboratory I	1	3A
CHEM 113 ^P	General Chemistry II	3	
CHEM 114 ^P	General Chemistry Laboratory II	1	
CO 150 ^P	College Composition	3	1A
LIFE 102 ^P	Attributes of Living Systems	4	3A
MATH 155 ^P	Calculus for Biological Scientists I	4	1B
OR			
MATH 160 ^P	Calculus for Physical Scientists I	4	1B
	Arts/humanities ¹	6	3B
	Social/behavioral sciences ²	3	3C
	TOTAL	29	
SOPHOMORE			
BMS 302 ^P	Laboratory in Principles of Physiology	2	
BMS 360 ^P	Fundamentals of Physiology	4	
<i>Select one set from the following:</i>			
CHEM 341 ^P	Modern Organic Chemistry I	3	
CHEM 343 ^P	Modern Organic Chemistry II	3	
CHEM 344 ^P	Modern Organic Chemistry Laboratory	2	
OR			
CHEM 345 ^P	Organic Chemistry I	4	
CHEM 346 ^P	Organic Chemistry II	4	
LIFE 201B ^P	Introductory Genetics-Molecular	3	
LIFE 210 ^P	Introductory Eukaryotic Cell Biology	3	
LIFE 212 ^P	Introductory Cell Biology Laboratory	2	
STAT 301 ^P	Introduction to Statistical Methods	3	
OR			
STAT 307 ^P	Introduction to Biostatistics	3	
	Additional communication ³	3	2B
	TOTAL	28	
JUNIOR			
BC 351 ^P	Principles of Biochemistry	4	
<i>Select one course from the following:</i>			
BMS 301 ^P	Human Gross Anatomy	5	
BMS 305 ^P	Domestic Animal Gross Anatomy	4	
BMS 330 ^P	Microscopic Anatomy	4	
MIP 300 ^P	General Microbiology	3	
MIP 302 ^P	General Microbiology Laboratory	2	
PH 121 ^P	General Physics I	5	
PH 122 ^P	General Physics II	5	
	Global and cultural awareness ⁴	3	3E
	Historical perspectives ⁵	3	3D
	Electives ⁶	2	
	TOTAL	31-32	
SENIOR			
BMS 460 ^P	Essentials of Pathophysiology	4	4A, 4B, 4C
BMS 492 ^P	Seminar-Pathophysiology of Disease	1	4A, 4C
	Major related electives ⁷	15	
	Free electives ⁸	11-12	
	TOTAL	31-32	
PROGRAM TOTAL = 120 credits			

^P This course has at least one prerequisite. Check the Courses of Instruction section of the catalog or <http://catalog.colostate.edu/front/courses-of-instruction.aspx> to see the course prerequisites.

¹ Select two courses from the list in category 3B in the All-University Core Curriculum (AUCC). Only 3 of the 6 credits required for arts and humanities may come from intermediate (L* 200 and L* 201) foreign language courses.

² Select from the list of courses in category 3C in the AUCC.

³ Select any advanced writing course listed in category 2B of the AUCC.

⁴ Select from the list of courses in category 3E in the AUCC.

⁵ Select from the list of courses in category 3D in the AUCC.

⁶ Free electives to complete degree program as chosen by student and adviser.

⁷ Major related elective approved by BMS key adviser (15 credits from approved lists at department).

⁸ Free electives to complete degree program at student's discretion. Enough upper division (300- and 400-level) credits must be taken to bring total number of upper division credits to 42.

Minor in Biomedical Sciences

The minor in biomedical sciences provides students with a useful complement to majors in biological science, zoology, health and exercise science, animal science, psychology, and other biomedical science areas. The program offers a variety of courses which serve to broaden the background of students pursuing professional careers in biomedical sciences, human and veterinary medicine, and a variety of health-related disciplines. Candidates begin the program with a course in either human or animal anatomy and physiology. The remainder of the required 21 credits is selected to complement the student's educational goals and interests.

A minimum grade of C (2.000) in either BMS 300 or BMS 360 will be required for those students who are seeking to graduate with a minor in biomedical sciences and who take one of these courses as fulfillment of the requirements.

Course	Title	Cr	AUCC
REQUIRED COURSES			
BMS 300 ^{P*}	Principles of Human Physiology	4	
OR			
BMS 360 ^{P*}	Fundamentals of Physiology	4	
<i>Select one course from the following:</i>			
BMS 301 ^{P*}	Human Gross Anatomy ¹	5	
BMS 305 ^{P*}	Domestic Animal Gross Anatomy ¹	4	
BMS 330 ^P	Microscopic Anatomy ¹	4	
<i>Select one course from the following:</i>			
BMS 325 ^P	Cellular Neurobiology ¹	3	
BMS 345 ^P	Functional Neuroanatomy ¹	4	
BMS 365 ^P	Nerve and Muscle-Toxins, Trauma, and Disease ¹	3	
TOTAL		11-13	
ELECTIVE COURSES			
BMS 200 ^P	Concepts in Human Anatomy and Physiology	1	
BMS 301 ^P	Human Gross Anatomy	5	
BMS 302 ^P	Laboratory in Principles of Physiology	2	
BMS 305 ^{P*}	Domestic Animal Gross Anatomy	4	
BMS 325 ^P	Cellular Neurobiology	3	
BMS 330 ^P	Microscopic Anatomy	4	
BMS 345 ^P	Functional Neuroanatomy	4	
BMS 365 ^P	Nerve and Muscle-Toxins, Trauma, and Disease	3	
BMS 384 ^P	Supervised College Teaching	Var	
BMS 420 ^P	Cardiopulmonary Physiology	3	
BMS 430 ^P	Endocrinology	3	
BMS 450 ^P	Pharmacology	3	
BMS 495	Independent Study	Var	
BMS 531 ^P	Domestic Animal Dissection	3	
BMS 575	Human Anatomy Dissection	4	
BZ 310 ^{P*}	Cell Biology	4	
BZ 311 ^P	Development Biology	4	
TOTAL		8-10	

PROGRAM TOTAL = 21 credits without prerequisites

^P This course has at least one prerequisite. Check the Courses of Instruction section of the catalog or <http://catalog.colostate.edu/front/courses-of-instruction.aspx> to see the course prerequisites.

¹ If these courses are not used as required courses, they may be used as elective courses.

*Additional course work may be required because of prerequisites.

Graduate Programs in Biomedical Sciences

Graduate programs lead to the Master of Science and Doctor of Philosophy degrees in biomedical science. Students

interested in graduate work should refer to the *Graduate and Professional Bulletin*, <http://graduateschool.colostate.edu/index.asp?url=catalog>, and the department's website, www.cvmb.colostate.edu/bms.

DEPARTMENT OF CLINICAL SCIENCES

Office in Veterinary Teaching Hospital, 300 West Drake Road, Room A201
(970) 297-1274
www.cvmb.colostate.edu/clinsci

Professor D. Paul Lunn, Head

The Department of Clinical Sciences is primarily involved with teaching veterinary students in the professional veterinary medicine program the diagnosis, medical and surgical treatment, and prevention and management of domestic and exotic animal diseases. Through field service clinical experience, students receive on-the-farm training in livestock herd health management and production medicine. Our major clinical training center is the Veterinary Teaching Hospital which operates state-of-the-art primary and referral services in all areas of small animal medicine and surgery, equine and food animal clinical care. Elective courses provide students the opportunity to select areas such as large animal reproduction, zoological medicine, imaging, and a wide variety of other veterinary specialties.

No undergraduate major is offered.

Graduate Programs in Clinical Sciences

Graduate programs in medicine, surgery, epidemiology, and integrated livestock management lead to a Master of Science or a Doctor of Philosophy degree. The department also offers a three-year combined master's degree and residency program in large and small animal surgery, dermatology, anesthesiology, cardiology, internal medicine, neurology, oncology, ophthalmology, and emergency and critical care medicine, which partially fulfills requirements for board certification. Students interested in graduate work should refer to the *Graduate and Professional Bulletin*, <http://graduateschool.colostate.edu/index.asp?url=catalog>, and the department's website, www.cvmb.colostate.edu/clinsci.

DEPARTMENT OF ENVIRONMENTAL AND RADIOLOGICAL HEALTH SCIENCES

Office in Environmental Health Building, Room 122
(97) 491-7038
www.cvmb.colostate.edu/erhs/

Professor Jac Nicoloff, Department Head

Major in Environmental Health

An environmental health degree prepares students for employment by public sector environmental agencies, private industry, academic institutions, as well as graduate study in medicine, veterinary medicine, and related biomedical and health fields. The basic science requirements for the major will meet all admission requirements for accredited medical and veterinary medical schools in North America. Free and major-related electives can be utilized to meet the unique requirements of a particular professional training program. The degree program is fully accredited by the standards of the National Environmental Health Science and Protection Accreditation Council. Before taking environmental health classes, students will study sciences including biology, physics, chemistry, calculus, and statistics, and then using all these basic sciences as tools to solve problems. Students are involved in actual and simulated field projects for data gathering and analysis, problems solution, and presentation of results in written and oral formats. Many undergraduates will spend summers on internships working in a variety of environmental health professions or research projects. Additionally, many will complete a professional internship for academic credit with a private sector company, environmental health agency, or research entity (public or private).

Learning Outcomes

Students will:

- Effectively communicate the health consequences of actions, behaviors, or environmental degradation to the public, political community, legal experts, or the media
- Demonstrate critical thinking and problem solving abilities for environmental issues as an individual and as a member of a problem solving team
- Integrate knowledge in social, physical, and biological sciences to evaluate environmental issues
- Apply knowledge of scientific methods to evaluate compliance with environmental health standards and assess risks to workers and the public

Potential Occupations

Career opportunities include, but are not limited to: environmental health specialist, public health specialist, industrial hygienist, toxicologist, epidemiologist, health education, air and water pollution specialist, hazardous and solid waste specialist, or health and safety specialist.

MATH 117, MATH 118, MATH 124, MATH 125, MATH 126, M CC 120A-B, and M CC 121 are considered review courses in the major. The courses do not count as part of the 120 credit program of study for the major in environmental health.

Course	Title	Cr	AUCC
FRESHMAN			
<i>Select one set from the following:</i>			
LIFE 103 ^P	Biology of Organisms and Plants	4	3A
OR			
LIFE 210 ^P	Introductory Eukaryotic Cell Biology	3	
LIFE 212 ^P	Introductory Cell Biology Laboratory	2	
CHEM 111 ^P	General Chemistry I	4	3A
CHEM 112 ^P	General Chemistry Laboratory I	1	3A
CHEM 113 ^P	General Chemistry II	3	
CHEM 114 ^P	General Chemistry Laboratory II	1	
CO 150 ^P	College Composition	3	1A
ERHS 220 ^P	Environmental Health	3	
LIFE 102 ^P	Attributes of Living Systems	4	3A
	Arts/humanities ¹	3	3B
	Social/behavioral sciences ²	3	3C
	Historical perspectives ³	3	3D
	TOTAL	32-33	
SOPHOMORE			
ERHS 230 ^P	Environmental Health Field Methods	3	
MATH 155 ^P	Calculus for Biological Scientists I	4	1B
PH 121 ^P	General Physics I	5	3A
PH 122 ^P	General Physics II	5	3A
STAT 307 ^P	Introduction to Biostatistics	3	
	Additional communication ⁴	3	2A or 2B
	Arts/humanities ¹	3	3B
	Global and cultural awareness ⁵	3	3E
	TOTAL	29	
JUNIOR			
BMS 300 ^P	Principles of Human Physiology	4	
<i>Select one set from the following:</i>			
CHEM 341 ^P	Modern Organic Chemistry I	3	
CHEM 343 ^P	Modern Organic Chemistry II	3	
CHEM 344 ^P	Modern Organic Chemistry Laboratory	2	
OR			
CHEM 345 ^P	Organic Chemistry I	4	
CHEM 346 ^P	Organic Chemistry II	4	
ERHS 300 ^P	Introduction to Radiation Biology	3	
ERHS 320 ^P	Environmental Health Water Quality	3	4A
ERHS 332 ^P	Principles of Epidemiology	3	
ERHS 350 ^P	Industrial Hygiene and Air	3	
ERHS 492	Environmental Health Seminar	1	
MIP 300 ^P	General Microbiology	3	
MIP 302 ^P	General Microbiology Laboratory	2	
	TOTAL	30	
SENIOR			
BC 351 ^P	Principles of Biochemistry	4	
ERHS 410 ^P	Environmental Health Waste Management	3	4B
ERHS 446 ^P	Environmental Toxicology	3	
ERHS 487	Internship-Environmental Health	7	4C
	Program electives ⁶	11-12	
	TOTAL	28-29	
PROGRAM TOTAL = 120 credits			

^P This course has at least one prerequisite. Check the Courses of Instruction section of the catalog or <http://catalog.colostate.edu/front/courses-of->

[instruction.aspx](#) to see the course prerequisites.

¹ Select from the list of courses in category 3B in the All-University Core Curriculum (AUCC). Only 3 of the 6 credits required for arts and humanities may come from intermediate (L* 200 and L* 201) foreign language courses.

² Select from the list of courses in category 3C in the AUCC.

³ Select from the list of courses in category 3D of the AUCC.

⁴ Select from the list of courses in category 2A or 2B in the AUCC. First-time students entering a college or university on or after July 1, 2008, must take and advanced writing course (category 2B).

⁵ Select from the list of courses in category 3E in the AUCC.

⁶ Must be related to major and approved by an ERHS key adviser.

Graduate Programs in Environmental and Radiological Health Sciences

The department offers graduate programs leading to Master of Science and Doctor of Philosophy degrees in environmental health and radiological health sciences. Areas of emphasis in environmental health include epidemiology, occupational health, ergonomics, and environmental toxicology. Areas of emphasis in radiological health include cancer biology, cellular and molecular radiobiology, radiation oncology, radiation protection/health physics, radiochemistry, radioecology, and veterinary radiology. Students interested in graduate work should refer to the *Graduate and Professional Bulletin*, <http://graduateschool.colostate.edu/index.asp?url=catalog>, and the department's website, www.cvmb.colostate.edu/erhs/.

DEPARTMENT OF MICROBIOLOGY, IMMUNOLOGY, AND PATHOLOGY

Office in Microbiology Building, Room B116
(970) 491-6136
www.cvmb.colostate.edu/mip/

Professor Edward Hoover, Department Head
Professor Herbert P. Schweizer, Associate Department Head and Associate Program Director,
RMRCE Associate Professor Susan M. Deines, Associate Head for Undergraduate Education
Associate Professor Gary Mason, Associate Head for PVM and Clinical Service
Associate Professor Sandra Quackenbush, Associate Head for Graduate Education

Major in Microbiology

Microbiology is the study of organisms, many of which are too small to be seen with the naked eye, including fungi, protists, and bacteria, and 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 the ecosystem and in industrial processes. Much work in this field is directed toward the cure, control, or eradication of disease in humans and animals. Genetically engineered microorganisms can also be used for the production of improved foods and new medicines, as well as for removing toxic wastes and spills from the environment. More recently, some microbes have received considerable attention as potential agents of bioterrorism and biowarfare, and consequently much work is being done to counter such threats.

Microbiology majors acquire knowledge and laboratory skill in the structure, physiology, genetics, pathogenicity, ecology, and taxonomy of microorganisms. Required courses in biological sciences, chemistry, physics, and mathematics support the major. Specialties are in human and animal infectious diseases, immunology, bacteriology, virology, molecular genetics, and environmental and industrial processes. Microbiology is an ideal major for students who are preparing for professional veterinary or human medical programs or graduate studies in various biological sciences, as well as direct entry into a career. Students may also elect to complete course work in several interdisciplinary programs, including biotechnology, food science/safety, and molecular biology.

Learning Outcomes

Students will demonstrate:

- Analysis of data and testing of theories
- Effective writing and speaking skills
- Critical thinking and problem solving skills
- Ability to work well both independently and with other scientists

Potential Occupations

Career opportunities in microbiology will continue to grow because microbiology is at the center of complex issues facing our world today, as well as at the forefront of incredible innovation and development. Employment is driven by continued demand in numerous sub-disciplines. Emerging human and animal disease presents a constant challenge. We rely on microbiologists both for the production and safety of our food (such as bread, beer, wine and cheese), and there is increasing concern for the impact of industrial and accidental pollution of our soil and water.

Biotechnology is a growing area where our graduates continue to be in demand. The first rough draft of the human genome in 2001 opened the door to advances in areas including recombinant DNA technology, drug discovery and biopharmaceutical development, functional genomics/proteomics and bioremediation. Renewed awareness of the potential threat of microbes as agents of bioterrorism drives the creation of programs and materials to combat these threats. The discoveries and uses of biotechnology continue to save lives and improve our environment.

Microbiology majors are found in research and production laboratories operated by government agencies (such as the CDC, FDA, public health departments, and the military), industry (such as biotechnology, pharmaceutical, food, beverage, and medical device manufacturers), technical sales and in university research and teaching. The level of education and the area of specialization determine employment opportunities. Part time laboratory work, internships, and cooperative education opportunities are highly recommended and will enhance a graduate's entry into permanent full time employment. Available career opportunities exist in many areas, including bacteriology, virology, mycology (study of fungi), immunology, microbial genetics, microbial physiology, environmental microbiology, bioremediation, and biodefense; product research and development, quality control and bioprocess development; and diagnostic microbiology.

Course	Title	Cr	AUCC
FRESHMAN			
CHEM 111 ^P	General Chemistry I	4	3A
CHEM 112 ^P	General Chemistry Laboratory I	1	3A
CHEM 113 ^P	General Chemistry II	3	
CHEM 114 ^P	General Chemistry Laboratory II	1	
CO 150 ^P	College Composition	3	1A
LIFE 102 ^P	Attributes of Living Systems	4	3A
MATH 155 ^P	Calculus for Biological Scientists I	4	1B
OR			
MATH 160 ^P	Calculus for Physical Scientists I	4	1B
	Additional communication	3	2A or 2B
	Biology elective ²	3-5	
	Microbiology elective ³	2	
	TOTAL	28-30	
SOPHOMORE			
CHEM 341 ^P	Modern Organic Chemistry I	3	
CHEM 343 ^P	Modern Organic Chemistry II	3	
CHEM 344 ^P	Modern Organic Chemistry Laboratory	2	
MIP 300 ^P	General Microbiology	3	
MIP 302 ^P	General Microbiology Laboratory	2	
MIP 342 ^P	Immunology	4	
STAT 301 ^P	Introduction to Statistical Methods	3	
OR			
STAT 307 ^P	Introduction to Biostatistics	3	
	Arts/humanities ⁴	3	3B
	Electives	6	
	TOTAL	29	
JUNIOR			
BC 351 ^P	Principles of Biochemistry	4	
MIP 351 ^P	Medical Bacteriology	3	4B
<i>Select one pair from the following:</i>			
PH 121 ^P	General Physics I	5	3A
PH 122 ^P	General Physics II	5	3A
OR			

Course	Title	Cr	AUCC
PH 141 ^P	Physics for Scientists and Engineers I	5	3A
PH 142 ^P	Physics for Scientists and Engineers II	5	3A
	Historical perspectives ⁵	3	3D
	Microbiology electives ³	5	
	Electives	4	
	TOTAL	29	
SENIOR			
<i>Select one course from the following:</i>			
MIP 400A ^P	Capstone in Microbiology-Medical Microbiology	2	4C
MIP 400B ^P	Capstone in Microbiology-Biotechnology	2	4C
MIP 400C ^P	Capstone in Microbiology-Immunology	2	4C
MIP 400D ^P	Capstone in Microbiology-Microbial Diversity/Ecology	2	4C
MIP 400E ^P	Capstone in Microbiology-Microbial Genetics	2	4C
MIP 400F ^P	Capstone in Microbiology-Virology	2	4C
MIP 400G ^P	Capstone in Microbiology-Service Learning	2	4C
MIP 498 ^P	Research	2-3	4C
MIP 420 ^P	Medical and Molecular Virology	4	4A
MIP 443 ^P	Microbial Physiology	4	4A
MIP 450 ^P	Microbial Genetics	3	
	Arts/humanities ⁴	3	3B
	Global and cultural awareness ⁶	3	3E
	Social/behavioral sciences ⁷	3	3C
	Microbiology electives ³	5	
	Electives ⁸	5-7	
	TOTAL	33-34	

PROGRAM TOTAL = 120 credits

^P This course has at least one prerequisite. Check the Courses of Instruction section of the catalog or <http://catalog.colostate.edu/front/courses-of-instruction.aspx> to see the course prerequisites.

¹ Select from the list of courses in category 2A or 2B in the All-University Core Curriculum (AUCC). First-time students entering a college or university on or after July 1, 2008, must take an advanced writing course.

² Select three to five credits from approved list in department.

³ Select from approved list in department. Two chosen courses must be formal MIP courses with a laboratory component.

⁴ Select from the list of courses in category 3B in the AUCC. Only 3 of the 6 credits required for arts and humanities may come from intermediate (L* 200 and L* 201) foreign language courses.

⁵ Select from the list of courses in category 3D in the AUCC.

⁶ Select from the list of courses in category 3E in the AUCC.

⁷ Select from the list of courses in category 3C in the AUCC.

⁸ Student may take 5-7 elective credits depending upon earlier biology or biochemistry choices to yield a 120 credit program.

Medical Technology Program

Students who complete the B.S. degree in microbiology are eligible to enter a 12-month medical technology internship at any hospital accredited by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS). Students are awarded a certificate in medical technology by the hospital at the conclusion of the internship and, upon successful completion of a national board examination, are certified to practice as professional clinical laboratory scientists. The demand for Clinical Laboratory Scientists far outweighs the supply of available personnel, and this shortage is expected to continue for some time.

Students who wish to enter a medical technology program should consult the key adviser in the Department of Microbiology, Immunology, and

Pathology for assistance in selection of elective courses, and in selecting and applying to an internship program.

Minor in Microbiology

A minor in microbiology will be of considerable benefit to students majoring in biological science, natural science, food science, biochemistry, some fields of engineering, and other science-related fields. Microbiology courses can be selected on the basis of students' specialized interest in biomedical, environment, industrial (biotechnology), or food microbiology.

<u>Course</u>	<u>Title</u>	<u>Cr</u>	<u>AUCC</u>
UPPER DIVISION			
MIP 300* ^P	General Microbiology	3	
MIP 302 ^P	General Microbiology Laboratory	2	
MIP 342 ^{P*}	Immunology	4	
A total of 12 credits must be selected from the following lists.			
<i>Select at least one course from each of the following pairs:</i>			
MIP 351 ^P	Medical Bacteriology	3	
	OR		
MIP 420 ^P	Medical and Molecular Virology	4	
MIP 443 ^{P*}	Microbial Physiology	4	
	OR		
MIP 450 ^{P*}	Microbial Genetics	3	
<i>Select 4-6 credits, including one laboratory course, from the following:</i>			
MIP 275	Microcomputing Applications in Microbiology	2	
MIP 334 ^P	Food Microbiology	3	
MIP 343 ^P	Immunology Laboratory	2	
MIP 350 ^P	Microbial Diversity	3	
MIP 351 ^P	Medical Bacteriology	3	

<u>Course</u>	<u>Title</u>	<u>Cr</u>	<u>AUCC</u>
MIP 352 ^P	Medical Bacteriology Laboratory	3	
MIP 420 ^P	Medical and Molecular Virology	4	
MIP 425 ^P	Virology and Cell Culture Laboratory	2	
MIP 432 ^P	Microbial Ecology	4	
MIP 436 ^P	Industrial Microbiology	4	
MIP 443 ^{P*}	Microbial Physiology	4	
MIP 450 ^{P*}	Microbial Genetics	3	
MIP 462 ^{P*/}	Parasitology and Vector Biology	5	
BZ 462 ^{P*/}			
BI 462 ^{P*}			
MIP 498 ^P	Research	Var	
PROGRAM TOTAL = 21 credits without prerequisites			

^P This course has at least one prerequisite. Check the Courses of Instruction section of the catalog or <http://catalog.colostate.edu/front/courses-of-instruction.aspx> to see the course prerequisites.
*Additional course work may be required because of prerequisites.

Graduate Programs in Microbiology, Immunology and Pathology

The department offers graduate programs leading to Master of Science, Doctor of Philosophy, and combined Doctor of Veterinary Medicine/Doctor of Philosophy degrees. A description of these programs may be found on the departmental Web site or in the *Graduate and Professional Bulletin*, <http://graduateschool.colostate.edu/index.asp?url=catalog>.

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