



Twin Cities Campus

Comparative and Molecular Biosciences M.S.

College of Veterinary Medicine - Adm

College of Veterinary Medicine

Link to a [list of faculty](#) for this program.

Contact Information:

College of Veterinary Medicine, 1365 Gortner Avenue, Room 443 VMC, Saint Paul, MN 55108 (612-625-3770; fax: 612-626-2825)

Email: cvmmsphd@umn.edu

Website: <http://www.cvm.umn.edu/cmb>

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- Length of program in credits: 30
- This program requires summer semesters for timely completion.
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

The mission of the Comparative and Molecular Biosciences (CMB) program is to train outstanding scientists in the basic mechanisms of animal and human health and disease.

The CMB program is transdisciplinary, bringing together basic, applied, and clinical scientists from a number of departments to provide students with individualized, cutting-edge biomedical research training. Areas of emphasis include genetic and infectious diseases, and comparative aspects of biology and pathology across animal species and humans. Students receive scientific training that prepares them for careers as independent investigators and educators in academia, industry, and government. The CMB program focuses on health that spans a wide range of species, from laboratory animal, companion animal, and livestock species to humans, and is unique within the University of Minnesota.

Note: The primary emphasis of the CMB program is the training of doctoral students; however, a small number of individuals complete a master's degree. The purpose of the master's degree is to provide technical training and scientific competence in the basic mechanisms of animal and human health and disease.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.25.

A bachelor's degree in a biological or basic science is required. Previous laboratory experience is strongly preferred.

Other requirements to be completed before admission:

Applicants must submit a C.V. or résumé; three letters of recommendation from persons familiar with their scholarship and research potential; and a statement of any research experience, as well as career interests, goals, and objectives.

Special Application Requirements:

Submission of all application materials by December 15 is required to ensure consideration for fall semester admission.

<http://www.cvm.umn.edu/students/ms-phd/CMB/index.htm>

Applicants must submit their test score(s) from the following:

- GRE

International applicants must submit score(s) from one of the following tests:

- TOEFL
 - Internet Based - Total Score: 79
 - Internet Based - Writing Score: 21
 - Internet Based - Reading Score: 19
 - Paper Based - Total Score: 550



- IELTS
 - Total Score: 6.5
 - Reading Score: 6.5
 - Writing Score: 6.5
- MELAB
 - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to [test abbreviations](#)(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

Program Requirements

Plan A: Plan A requires 20 major credits, 0 credits outside the major, and 10 thesis credits. The final exam is written and oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

The M.S. requires a minimum of 20 course credits and 10 thesis credits. The 20 course credits include 11 credits from CMB courses. A statistics course is required. A minimum of 5 additional course credits from the biological sciences are also required. A minimum GPA of at least 3.0 is required to maintain satisfactory progress and to graduate.

CMB Program Courses

A minimum of 11 course credits are required. CMB 8550 must be taken twice.

- [CMB 8134](#) - Ethical Conduct of Animal Research (3.0 cr)
- [CMB 8202](#) - Mechanisms of Animal Health and Disease II (3.0 cr)
- [CMB 8303](#) - Comparative Models of Disease (2.0 cr)
- [CMB 8550](#) - Comparative and Molecular Biosciences Seminar (1.0 cr)
- [CMB 8560](#) - Research and Literature Reports (1.0 cr)

Statistics

One of the following statistics courses is required.

- [CMB 5200](#) - Statistical Genetics and Genomics (4.0 cr)
- or [PUBH 6450](#) - Biostatistics I (4.0 cr)
- or [PUBH 6451](#) - Biostatistics II (4.0 cr)
- or [STAT 5021](#) - Statistical Analysis (4.0 cr)
- or [STAT 5031](#) - Statistical Methods for Quality Improvement (4.0 cr)
- or [STAT 5302](#) - Applied Regression Analysis (4.0 cr)
- or [STAT 5303](#) - Designing Experiments (4.0 cr)
- or [STAT 5421](#) - Analysis of Categorical Data (3.0 cr)

Additional courses

A minimum of 5 course credits required, primarily from the biological sciences. These courses can be selected from the following list or in consultation with the advisor.

- [MICA 8002](#) - Structure, Function, and Genetics of Bacteria and Viruses (4.0 cr)
- or [MICA 8003](#) - Immunity and Immunopathology (4.0 cr)
- or [MICA 8004](#) - Cellular and Cancer Biology (4.0 cr)
- or [MICA 8009](#) - Biochemical Aspects of Normal and Abnormal Cell Growth and Cell Death (2.0 cr)
- or [MICA 8010](#) - Microbial Pathogenesis (3.0 cr)
- or [MICA 8371](#) - Mucosal Immunobiology (3.0 cr)
- or [BIOC 5361](#) - Microbial Genomics and Bioinformatics (3.0 cr)
- or [BIOC 6021](#) - Biochemistry (3.0 cr)
- or [BIOC 8002](#) - Molecular Biology and Regulation of Biological Processes (3.0 cr)
- or [BIOC 8216](#) - Signal Transduction and Gene Expression (3.0 cr)
- or [GCD 5036](#) - Molecular Cell Biology (3.0 cr)
- or [GCD 8008](#) - Mammalian Gene Transfer and Expression (2.0 cr)
- or [GCD 8073](#) - Advanced Human Genetics (3.0 cr)
- or [GCD 8131](#) - Advanced Molecular Genetics and Genomics (3.0 cr)



- or [GCD 8151](#) - Cell Structure and Function (3.0 cr)
- or [GCD 8161](#) - Advanced Developmental Biology (3.0 cr)
- or [CMB 5200](#) - Statistical Genetics and Genomics (4.0 cr)
- or [CMB 5594](#) - Directed Research in Comparative and Molecular Biosciences (1.0 - 4.0 cr)
- or [CMB 5910](#) - Grantwriting: What Makes a Winning Proposal? (2.0 cr)
- or [CMB 8208](#) - Neuropsychopharmacology (3.0 cr)
- or [CMB 8344](#) - Mechanisms of Hormone Action (2.0 cr)
- or [CMB 8361](#) - Neuro-Immune Interactions (3.0 cr)
- or [CMB 8371](#) - Mucosal Immunobiology (3.0 cr)
- or [CMB 8481](#) - Advanced Neuropharmaceutics (4.0 cr)



Twin Cities Campus

Comparative and Molecular Biosciences Ph.D.

College of Veterinary Medicine - Adm

College of Veterinary Medicine

Link to a [list of faculty](#) for this program.

Contact Information:

College of Veterinary Medicine, 1365 Gortner Avenue, Room 443 VMC, Saint Paul, MN 55108 (612-625-3770; fax: 612-626-2825)

Email: cvmmsphd@umn.edu

Website: <http://www.cvm.umn.edu/cmb>

- Program Type: Doctorate
- Requirements for this program are current for Fall 2016
- Length of program in credits: 48
- This program requires summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

The mission of the comparative and molecular biosciences (CMB) program is to train outstanding scientists in the basic mechanisms of animal and human health and disease.

The CMB program is transdisciplinary, bringing together basic, applied, and clinical scientists from a number of departments to provide students with individualized, cutting-edge biomedical research training. Areas of emphasis include genetic and infectious diseases, and comparative aspects of biology and pathology across animal species and humans. Students receive scientific training that prepares them for careers as independent investigators and educators in academia, industry, and government. The CMB program focuses on health that spans a wide range of species, from laboratory animal, companion animal, and livestock species to humans, and is unique within the University of Minnesota.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.25.

A bachelor's degree in a biological or basic science is required. Previous research experience is expected but not required.

Other requirements to be completed before admission:

Applicants must submit a C.V. or résumé; three letters of recommendation from persons familiar with their scholarship and research potential; and a statement of any research experience, as well as career interests, goals, and objectives.

Special Application Requirements:

Submission of all application materials by December 15 is required to ensure consideration for admission, fellowships, and research assistantships awarded for the next academic year. <http://www.cvm.umn.edu/students/ms-phd/CMB/index.htm>

Applicants must submit their test score(s) from the following:

- GRE

International applicants must submit score(s) from one of the following tests:

- TOEFL
 - Internet Based - Total Score: 79
 - Internet Based - Writing Score: 21
 - Internet Based - Reading Score: 19
 - Paper Based - Total Score: 550
- IELTS
 - Total Score: 6.5
 - Reading Score: 6.5
 - Writing Score: 6.5



- MELAB
- Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to [test abbreviations](#)(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

Program Requirements

24 credits are required in the major.

0 credits are required outside the major.

24 thesis credits are required.

Plan A: Plan A requires 20 major credits, 0 credits outside the major, and 10 thesis credits. The final exam is written and oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

The PhD requires a minimum of 24 course credits and 24 thesis credits. The 24 course credits include 13 credits of CMB program courses. A statistics course is required. A minimum of 7 additional course credits from the biological sciences are also required. In addition, all students are required to complete a teaching experience. A minimum GPA of at least 3.00 is required to maintain satisfactory progress and to graduate.

CMB program courses

A minimum of 13 course credits are required. CMB 8100 must be taken twice and CMB 8550 must be taken twice.

- [CMB 5910](#) - Grantwriting: What Makes a Winning Proposal? (2.0 cr)
- [CMB 8100](#) - Research Rotation in Comparative and Molecular Biosciences (1.0 cr)
- [CMB 8134](#) - Ethical Conduct of Animal Research (3.0 cr)
- [CMB 8202](#) - Mechanisms of Animal Health and Disease II (3.0 cr)
- [CMB 8303](#) - Comparative Models of Disease (2.0 cr)
- [CMB 8550](#) - Comparative and Molecular Biosciences Seminar (1.0 cr)
- [CMB 8560](#) - Research and Literature Reports (1.0 cr)

Statistics

One of the following statistics courses is required.

- [CMB 5200](#) - Statistical Genetics and Genomics (4.0 cr)
- or [PUBH 6450](#) - Biostatistics I (4.0 cr)
- or [PUBH 6451](#) - Biostatistics II (4.0 cr)
- or [STAT 5021](#) - Statistical Analysis (4.0 cr)
- or [STAT 5031](#) - Statistical Methods for Quality Improvement (4.0 cr)
- or [STAT 5302](#) - Applied Regression Analysis (4.0 cr)
- or [STAT 5303](#) - Designing Experiments (4.0 cr)
- or [STAT 5421](#) - Analysis of Categorical Data (3.0 cr)

Additional courses

A minimum of 7 course credits are required, selected from the following list or in consultation with the advisor. Students may take GRAD 8101 OR GRAD 8200 but not both.

- [MICA 8002](#) - Structure, Function, and Genetics of Bacteria and Viruses (4.0 cr)
- or [MICA 8003](#) - Immunity and Immunopathology (4.0 cr)
- or [MICA 8004](#) - Cellular and Cancer Biology (4.0 cr)
- or [MICA 8009](#) - Biochemical Aspects of Normal and Abnormal Cell Growth and Cell Death (2.0 cr)
- or [MICA 8010](#) - Microbial Pathogenesis (3.0 cr)
- or [MICA 8371](#) - Mucosal Immunobiology (3.0 cr)
- or [BIOC 5361](#) - Microbial Genomics and Bioinformatics (3.0 cr)
- or [BIOC 6021](#) - Biochemistry (3.0 cr)
- or [BIOC 8002](#) - Molecular Biology and Regulation of Biological Processes (3.0 cr)
- or [BIOC 8216](#) - Signal Transduction and Gene Expression (3.0 cr)
- or [GCD 5036](#) - Molecular Cell Biology (3.0 cr)



or [GCD 8008](#) - Mammalian Gene Transfer and Expression (2.0 cr)
or [GCD 8073](#) - Advanced Human Genetics (3.0 cr)
or [GCD 8131](#) - Advanced Molecular Genetics and Genomics (3.0 cr)
or [GCD 8151](#) - Cell Structure and Function (3.0 cr)
or [GCD 8161](#) - Advanced Developmental Biology (3.0 cr)
or [CMB 5200](#) - Statistical Genetics and Genomics (4.0 cr)
or [CMB 5910](#) - Grantwriting: What Makes a Winning Proposal? (2.0 cr)
or [CMB 8208](#) - Neuropsychopharmacology (3.0 cr)
or [CMB 8344](#) - Mechanisms of Hormone Action (2.0 cr)
or [CMB 8361](#) - Neuro-Immune Interactions (3.0 cr)
or [CMB 8371](#) - Mucosal Immunobiology (3.0 cr)
or [CMB 8394](#) - Research in Comparative Biomedical Sciences (1.0 - 6.0 cr)
or [CMB 8481](#) - Advanced Neuropharmaceutics (4.0 cr)
or [GRAD 8101](#) - Teaching in Higher Education (3.0 cr)
or [GRAD 8200](#) - Teaching and Learning Topics in Higher Education (1.0 cr)

Thesis Credits

Take at least 24 doctoral thesis credits

[CMB 8888](#) - Thesis Credit: Doctoral (1.0 - 24.0 cr)



Twin Cities Campus

Veterinary Medicine M.S.

College of Veterinary Medicine - Adm

College of Veterinary Medicine

Link to a [list of faculty](#) for this program.

Contact Information:

College of Veterinary Medicine, 1365 Gortner Avenue, Room 443 VMC, Saint Paul, MN 55108 (612-625-3770; fax: 612-626-2825)

Email: cvmmsphd@umn.edu

Website: <http://www.cvm.umn.edu/vmed>

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- Length of program in credits: 30
- This program requires summer semesters for timely completion.
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

The mission of the veterinary medicine graduate program is to promote science-based research and provide high-quality education to develop scientists who work to improve the health and well-being of animals and humans.

Program Goals:

- Prepare independent, basic, and applied scientists for successful careers in academia, industry, government, or veterinary practice
- Foster development of specific skills including leadership, communication, independent and critical thinking, teaching, interdisciplinary research in collaborative environments, scientific and grant writing, experimental and analytical methods
- Contribute to the body of knowledge in basic, translational, and applied sciences in animal health and well-being, and emerging and zoonotic threats

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.25.

D.V.M. or equivalent; students with a B.A. or B.S. in biological sciences may be considered. Previous laboratory experience is preferred.

Other requirements to be completed before admission:

Applicants must submit a C.V. or résumé, three letters of recommendation from persons familiar with their scholarship and research potential, and a statement of any research experience, as well as career interests, goals, and objectives.

Special Application Requirements:

Submission of all application materials by December 15 is required to ensure consideration for admission, fellowships, and research assistantships awarded for the next academic year.

International applicants must submit score(s) from one of the following tests:

- TOEFL
 - Internet Based - Total Score: 79
 - Internet Based - Writing Score: 21
 - Internet Based - Reading Score: 19
 - Paper Based - Total Score: 550
- IELTS
 - Total Score: 6.5
 - Reading Score: 6.5
 - Writing Score: 6.5
- MELAB
 - Final score: 80



The preferred English language test is Test of English as Foreign Language

Key to [test abbreviations](#)(TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

Program Requirements

Plan A: Plan A requires 20 major credits, up to null credits outside the major, and 10 thesis credits. The final exam is written and oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

The M.S. requires a minimum of 20 course credits and 10 thesis credits. The 20 course credits include Ethics VMED8134, Student Seminar VMED8550, a Statistics course, and at least 1 additional 8000 level course in the biological sciences. Student Seminar VMED8550 must be taken twice. Additional course credits may be required to meet the 20-credit minimum.

Ethics

An animal ethics course is required.

[VMED 8134](#) - Ethical Conduct of Animal Research (3.0 cr)

Seminar

The student seminar course is required to be taken two times.

[VMED 8550](#) - Veterinary Medicine Seminar (1.0 cr)

Statistics

At least one statistics course is required, but two courses are recommended.

[PUBH 6414](#) - Biostatistical Literacy (3.0 cr)

or [PUBH 6450](#) - Biostatistics I (4.0 cr)

or [PUBH 6451](#) - Biostatistics II (4.0 cr)

or [STAT 5021](#) - Statistical Analysis (4.0 cr)

or [STAT 5031](#) - Statistical Methods for Quality Improvement (4.0 cr)

or [STAT 5302](#) - Applied Regression Analysis (4.0 cr)

or [STAT 5303](#) - Designing Experiments (4.0 cr)

or [STAT 5421](#) - Analysis of Categorical Data (3.0 cr)

8000 level courses

At least one additional 8000 level course in the biological sciences. CMB 8202 is recommended. Consult your advisor to identify an appropriate 8000 level course. Suggestions are listed.

[BIOC 8002](#) - Molecular Biology and Regulation of Biological Processes (3.0 cr)

or [BIOC 8216](#) - Signal Transduction and Gene Expression (3.0 cr)

or [GCD 8008](#) - Mammalian Gene Transfer and Expression (2.0 cr)

or [GCD 8073](#) - Advanced Human Genetics (3.0 cr)

or [GCD 8131](#) - Advanced Molecular Genetics and Genomics (3.0 cr)

or [GCD 8151](#) - Cell Structure and Function (3.0 cr)

or [GCD 8161](#) - Advanced Developmental Biology (3.0 cr)

or [CMB 8202](#) - Mechanisms of Animal Health and Disease II (3.0 cr)

or [CMB 8303](#) - Comparative Models of Disease (2.0 cr)

or [CMB 8344](#) - Mechanisms of Hormone Action (2.0 cr)

or [VMED 8192](#) - Dairy Health Management: Critical Thinking (1.0 cr)

or [VMED 8193](#) - Welfare of Farmed Animals (1.0 cr)

or [VMED 8394](#) - Research in Veterinary Medicine (1.0 - 3.0 cr)

or [VMED 8492](#) - Seminar: Infectious Diseases and Swine Medicine (1.0 cr)

or [VMED 8592](#) - Infectious Disease Journals: Critical Thinking (1.0 cr)

Additional course credits in the biological sciences

Depending on the total number of course credits completed with the 1 - 8000 level course in the biological sciences, at least 9 additional course credits are required. Consult your advisor to identify appropriate courses. It is suggested that these courses be considered to fulfill these additional course credits.



VPM 4131 - Immunology (3.0 cr)
or CMB 5200 - Statistical Genetics and Genomics (4.0 cr)
or VMED 5165 - Surveillance of Foodborne Diseases and Food Safety Hazards (2.0 cr)
or VMED 5180 - Ecology of Infectious Disease (3.0 cr)
or VMED 5181 - Spatial Analysis in Infectious Disease Epidemiology (3.0 cr)
or VMED 5190 - Seminar and Presentation Development (2.0 cr)
or VMED 5420 - Molecular Epidemiology of Infectious Disease (3.0 cr)
or VMED 5442 - Quantitative Methods for Analysis of Food Animal Disease Data (4.0 cr)
or VMED 5594 - Research in Veterinary Medicine (1.0 - 4.0 cr)
or VMED 5910 - Grant Writing: What Makes a Winning Proposal? (2.0 cr)
or VMED 5920 - Food Defense: Prepare, Respond, Recover (3.0 cr)
or VMED 5921 - Seminar in Food Protection and Defense (1.0 cr)
or PUBH 6341 - Epidemiologic Methods I (3.0 cr)
or PUBH 6342 - Epidemiologic Methods II (3.0 cr)
or PUBH 6343 - Epidemiologic Methods III (4.0 cr)
or PUBH 6350 - Epidemiologic Methods III: Lab (1.0 cr)
or PUBH 6385 - Epidemiology and Control of Infectious Diseases (2.0 cr)
or BIOC 8002 - Molecular Biology and Regulation of Biological Processes (3.0 cr)
or BIOC 8216 - Signal Transduction and Gene Expression (3.0 cr)
or GCD 8008 - Mammalian Gene Transfer and Expression (2.0 cr)
or GCD 8073 - Advanced Human Genetics (3.0 cr)
or GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
or GCD 8151 - Cell Structure and Function (3.0 cr)
or GCD 8161 - Advanced Developmental Biology (3.0 cr)
or CMB 8202 - Mechanisms of Animal Health and Disease II (3.0 cr)
or CMB 8303 - Comparative Models of Disease (2.0 cr)
or CMB 8344 - Mechanisms of Hormone Action (2.0 cr)
or VMED 8192 - Dairy Health Management: Critical Thinking (1.0 cr)
or VMED 8193 - Welfare of Farmed Animals (1.0 cr)
or VMED 8394 - Research in Veterinary Medicine (1.0 - 3.0 cr)
or VMED 8492 - Seminar: Infectious Diseases and Swine Medicine (1.0 cr)
or VMED 8592 - Infectious Disease Journals: Critical Thinking (1.0 cr)



Twin Cities Campus

Veterinary Medicine Ph.D.

College of Veterinary Medicine - Adm

College of Veterinary Medicine

Link to a [list of faculty](#) for this program.

Contact Information:

College of Veterinary Medicine, 1365 Gortner Avenue, Room 443 VMC, Saint Paul, MN 55108 (612-625-3770; fax: 612-626-2825)

Email: cvmmsphd@umn.edu

Website: <http://www.vetmed.umn.edu/education-training/ms-phd-programs>

- Program Type: Doctorate
- Requirements for this program are current for Fall 2016
- Length of program in credits: 48
- This program requires summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

The veterinary medicine graduate program focuses on the scientific study of the mechanisms of transmission and progression of diseases of importance to domestic animals, wildlife and humans with applications to diagnosis, prevention, and treatment. Includes training in infectious and noninfectious disease, epidemiology, environmental biology, ethology, anatomical, clinical and molecular pathobiology.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.25.

DVM or equivalent; students with a BA or BS in biological sciences may be considered. Previous laboratory experience is preferred.

Other requirements to be completed before admission:

Applicants must submit a CV or résumé; three letters of recommendation from persons familiar with their scholarship and research potential; and a statement of any research experience, as well as career interests, goals, and objectives.

Special Application Requirements:

Submission of all application materials by December 15 is required to ensure consideration for fellowships and research assistantships awarded for the next academic year.

Applicants must submit their test score(s) from the following:

- GRE

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- IELTS
 - Total Score: 6.5
- MELAB
 - Final score: 80

The preferred English language test is Test of English as Foreign Language

Key to [test abbreviations](#)(GRE, TOEFL, IELTS, MELAB).



For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

Program Requirements

24 credits are required in the major.

0 credits are required outside the major.

24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

Ethics Course Requirement

Take the following animal ethics course:

[VMED 8134](#) - Ethical Conduct of Animal Research (3.0 cr)

Seminar Requirement

Take VMED 8550 twice for a total of 2 credits.

[VMED 8550](#) - Veterinary Medicine Seminar (1.0 cr)

Statistics Requirement

A minimum of one Statistics course is required. Two Statistics courses are preferred. Select coursework in consultation with the advisor.

[PUBH 6414](#) - Biostatistical Literacy (3.0 cr)

or [PUBH 6450](#) - Biostatistics I (4.0 cr)

or [PUBH 6451](#) - Biostatistics II (4.0 cr)

or [STAT 5021](#) - Statistical Analysis (4.0 cr)

or [STAT 5031](#) - Statistical Methods for Quality Improvement (4.0 cr)

or [STAT 5302](#) - Applied Regression Analysis (4.0 cr)

or [STAT 5303](#) - Designing Experiments (4.0 cr)

or [STAT 5421](#) - Analysis of Categorical Data (3.0 cr)

8xxx-Level Coursework Requirement

Take at least 3 8xxx-level biological sciences courses from the following list, or select others, in consultation with the advisor. CMB 8202 is recommended.

[BIOC 8002](#) - Molecular Biology and Regulation of Biological Processes (3.0 cr)

or [BIOC 8216](#) - Signal Transduction and Gene Expression (3.0 cr)

or [GCD 8008](#) - Mammalian Gene Transfer and Expression (2.0 cr)

or [GCD 8073](#) - Advanced Human Genetics (3.0 cr)

or [GCD 8131](#) - Advanced Molecular Genetics and Genomics (3.0 cr)

or [GCD 8151](#) - Cell Structure and Function (3.0 cr)

or [GCD 8161](#) - Advanced Developmental Biology (3.0 cr)

or [CMB 8100](#) - Research Rotation in Comparative and Molecular Biosciences (1.0 cr)

or [CMB 8202](#) - Mechanisms of Animal Health and Disease II (3.0 cr)

or [CMB 8303](#) - Comparative Models of Disease (2.0 cr)

or [CMB 8344](#) - Mechanisms of Hormone Action (2.0 cr)

or [VMED 8192](#) - Dairy Health Management: Critical Thinking (1.0 cr)

or [VMED 8193](#) - Welfare of Farmed Animals (1.0 cr)

or [VMED 8394](#) - Research in Veterinary Medicine (1.0 - 3.0 cr)

or [VMED 8492](#) - Seminar: Infectious Diseases and Swine Medicine (1.0 cr)

or [VMED 8592](#) - Infectious Disease Journals: Critical Thinking (1.0 cr)

Additional Coursework

Take additional courses from the following list, or select others in consultation with the advisor, to complete the minimum course credit requirement.

[VPM 4131](#) - Immunology (3.0 cr)

or [CMB 5200](#) - Statistical Genetics and Genomics (4.0 cr)

or [VMED 5165](#) - Surveillance of Foodborne Diseases and Food Safety Hazards (2.0 cr)

or [VMED 5180](#) - Ecology of Infectious Disease (3.0 cr)

or [VMED 5181](#) - Spatial Analysis in Infectious Disease Epidemiology (3.0 cr)

or [VMED 5190](#) - Seminar and Presentation Development (2.0 cr)



- or [VMED 5420](#) - Molecular Epidemiology of Infectious Disease (3.0 cr)
- or [VMED 5442](#) - Quantitative Methods for Analysis of Food Animal Disease Data (4.0 cr)
- or [VMED 5594](#) - Research in Veterinary Medicine (1.0 - 4.0 cr)
- or [VMED 5596](#) - Swine Diseases and Diagnostics (2.0 - 3.0 cr)
- or [VMED 5910](#) - Grant Writing: What Makes a Winning Proposal? (2.0 cr)
- or [VMED 5921](#) - Seminar in Food Protection and Defense (1.0 cr)
- or [PUBH 6341](#) - Epidemiologic Methods I (3.0 cr)
- or [PUBH 6342](#) - Epidemiologic Methods II (3.0 cr)
- or [PUBH 6343](#) - Epidemiologic Methods III (4.0 cr)
- or [PUBH 6350](#) - Epidemiologic Methods III: Lab (1.0 cr)
- or [PUBH 6385](#) - Epidemiology and Control of Infectious Diseases (2.0 cr)

Thesis Credits

Take at least 24 doctoral thesis credits.

[VMED 8888](#) - Thesis Credit: Doctoral (1.0 - 24.0 cr)