**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](http://www.cvm.umn.edu/cmb)

- Program Type: Master's
- Requirements for this program are current for Fall 2018
- 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 embraces a One Health approach and investigates a wide range of species, including humans, laboratory animals, companion animals, and livestock species.

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 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 1 is required to ensure consideration for fall semester admission.

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
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 towards program requirements is not permitted.

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 CMB 8910 - Statistical Principles of Research Design (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)

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 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 Genome Engineering (2.0 cr)
- or GCD 8073 - Genetics & Genomics in Human Health (3.0 cr)
- or GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
- or GCD 8151 - Cellular Biochemistry and Cell Biology (2.0 - 4.0 cr)
- or GCD 8161 - Advanced Cell Biology and Development (3.0 cr)
or CMB 5200 - Statistical Genetics and Genomics (4.0 cr)
or CMB 5571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 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)
or CMB 8571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 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 2018
- 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 embraces a One Health approach and investigates a wide range of species, including humans, laboratory animals, companion animals, and livestock species. 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.

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 1 is required to ensure consideration for admission, fellowships, and research assistantships awarded for the next academic year. https://www.vetmed.umn.edu/education-training/ms-phd-programs/ms-phd-comparative-and-molecular-biosciences

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

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Information current as of August 31, 2018
The preferred English language test is Test of English as Foreign Language (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 towards program requirements is not permitted.

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 15 credits of CMB program courses. A statistics course is required. A minimum of 6 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 15 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 CMB 8910 - Statistical Principles of Research Design (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)

Additional courses
A minimum of 6 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 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 Genome Engineering (2.0 cr)
- or GCD 8073 - Genetics & Genomics in Human Health (3.0 cr)
- or GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
or GCD 8151 - Cellular Biochemistry and Cell Biology (2.0 - 4.0 cr)
or GCD 8161 - Advanced Cell Biology and Development (3.0 cr)
or CMB 5200 - Statistical Genetics and Genomics (4.0 cr)
or CMB 5571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 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 CMB 8571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 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: cvmmspdd@umn.edu
Website: http://www.vetmed.umn.edu/education-training/ms-phd-programs

- Program Type: Master's
- Requirements for this program are current for Fall 2018
- Length of program in credits: 30
- This program requires summer semesters for timely completion.
- NO
- 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 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.

Accreditation
This program is accredited by NA

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 1 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.

VMED Program Courses

Take the following courses for 9 credits. VMED 8550 must be taken twice.

VMED 5190 - Seminar and Presentation Development (2.0 cr)
VMED 5910 - Grant Writing: What Makes a Winning Proposal? (2.0 cr)
VMED 8134 - Ethical Conduct of Animal Research (3.0 cr)
VMED 8550 - Veterinary Medicine Seminar (1.0 cr)

Statistics

Take at least one statistics course. Two courses are recommended.

VMED 8910 - Statistical Principles of Research Design (3.0 cr)
or 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

Take at least one additional 8000-level course in the biological sciences, 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 Genome Engineering (2.0 cr)
or GCD 8073 - Genetics & Genomics in Human Health (3.0 cr)
or GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
or GCD 8151 - Cellular Biochemistry and Cell Biology (2.0 - 4.0 cr)
or GCD 8161 - Advanced Cell Biology and Development (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 CMB 8571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 cr)
or VMED 8192 - Dairy Health Management: Critical Thinking (3.0 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 biological sciences coursework

Take at least 7 additional course credits, in consultation with the advisor.

VPM 4131 - Immunology (3.0 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 5182 - Molecular biology for the Public Health Professional (2.0 cr)
or VMED 5190 - Seminar and Presentation Development (2.0 cr)
or VMED 5442 - Quantitative Methods for Population Health (3.0 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 CMB 5200 - Statistical Genetics and Genomics (4.0 cr)
or CMB 5571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 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 Genome Engineering (2.0 cr)
or GCD 8073 - Genetics & Genomics in Human Health (3.0 cr)
or GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
or GCD 8151 - Cellular Biochemistry and Cell Biology (2.0 - 4.0 cr)
or GCD 8161 - Advanced Cell Biology and Development (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 CMB 8571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 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 CMED 8492 - Seminar: Infectious Diseases and Swine Medicine (1.0 cr)
or VMED 8592 - Infectious Disease Journals: Critical Thinking (1.0 cr)
or VMED 5440 - Using Risk Analysis Tools: Estimating Food Safety Risks on the Farm to Table Continuum (2.0 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: cvmmspdh@umn.edu
Website: http://www.vetmed.umn.edu/education-training/ms-phd-programs

- Program Type: Doctorate
- Requirements for this program are current for Fall 2018
- Length of program in credits: 48
- This program requires summer semesters for timely completion.
- NO
- 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.

Accreditation
This program is accredited by NA

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 1 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

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.

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.

VMED Program Courses
Take the following courses for 9 credits. VMED 8550 must be taken twice.
VMED 5190 - Seminar and Presentation Development (2.0 cr)
VMED 5910 - Grant Writing: What Makes a Winning Proposal? (2.0 cr)
VMED 8134 - Ethical Conduct of Animal Research (3.0 cr)
VMED 8550 - Veterinary Medicine Seminar (1.0 cr)

Statistics Requirement
Take at least one statistics course, in consultation with the advisor. Two statistics courses are preferred.
VMED 8910 - Statistical Principles of Research Design (3.0 cr)
or 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 Coursework Requirement
Take at least 3 8000-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 Genome Engineering (2.0 cr)
or GCD 8073 - Genetics & Genomics in Human Health (3.0 cr)
or GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
or GCD 8151 - Cellular Biochemistry and Cell Biology (2.0 - 4.0 cr)
or GCD 8161 - Advanced Cell Biology and Development (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 CMB 8571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 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 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 5182 - Molecular biology for the Public Health Professional (2.0 cr)

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

or VMED 5442 - Quantitative Methods for Population Health (3.0 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 CMB 5200 - Statistical Genetics and Genomics (4.0 cr)

or CMB 5571 - Pathogenomics and Molecular Epidemiology - Learning to Fly (3.0 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)