The Comparative Biomedical Sciences (CBMS) graduate program emphasizes an integrated approach to contemporary biology that combines molecular and cellular techniques with the analysis of complex whole animal systems. Faculty provide exceptional graduate and undergraduate interdisciplinary research training opportunities in core areas of animal and human health including immunology, molecular and cellular biology, physiology, neuroscience, genomics, oncology, virology, medical technology, infectious diseases and toxicology and pharmacology. They also contribute extensive public services, both nationally and internationally, within related faculty disciplines.

The graduate program serves as a focal point for graduate research training in the School of Veterinary Medicine (SVM) and is administered by the Department of Pathobiological Sciences. Trainers in CBMS have their tenure homes in all four departments of the School of Veterinary Medicine as well as in the College of Agricultural and Life Sciences (CALS), the School of Medicine and Public Health (SMPH), the College of Engineering, and the College of Letters & Science. Faculty in the CBMS program also serve in or interface with other campus training programs including bacteriology, biocore, cellular and molecular biology, endocrinology and reproductive physiology, medical microbiology and immunology, molecular and environmental toxicology, and the Primate Center.

Currently, there are over 95 faculty trainers in the Comparative Biomedical Sciences program. Affiliate faculty outside the School of Veterinary Medicine have their tenure homes in the Departments of Anatomy, Animal Sciences, Biochemistry, Dermatology, Entomology, Human Oncology, Medical Microbiology and Immunology, Medicine, Neurosurgery, Ophthalmology and Visual Sciences, Pathology and Laboratory Medicine, Population Health Sciences, Radiology, and Surgery. The program is currently comprised of approximately 50 graduate students, most of whom are pursuing the Ph.D. degree. The program is recognized as a premier research and graduate training program for students with or without a degree in veterinary medicine.

Admission is competitive. Applicants must hold a B.S., DVM., M.S., M.A. or M.D. from an approved institution and have a strong background in biology and chemistry. Applications are judged on the basis of previous academic record, graduate record exam (GRE) scores, letters of recommendation, and the personal statement. Before admission, most students must be accepted by an eligible program faculty member who agrees to serve as the major professor. A limited number of students may be offered rotations. Applications for summer (June) or fall (September) admission must be received by January 1 and spring (January) applications must be received by June 1. Historically, most students start in the fall semester.

Graduate admissions is a two-step process between academic degree programs and the Graduate School. Applicants must meet requirements of both the program(s) and the Graduate School. Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/admissions).

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding) is available from the Graduate School. Be sure to check with your program for individual policies and processes related to funding.

PROGRAM RESOURCES

Most graduate students receive financial support through fellowships, research assistantships through their major professor, and/or National Research Service Awards. Faculty in the program are PIs for Training Grants (Parasitology and Vector Biology Training Program, Comparative Biomedical Sciences Research Training for Veterinarians, and Research Training for Veterinary Medical Students) for which students with the appropriate background and credentials may compete.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

<table>
<thead>
<tr>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Mode of Instruction Definitions

- **Evening/Weekend**: These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.
- **Online**: These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.
- **Hybrid**: These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.
- **Accelerated**: These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.
CURRICULAR REQUIREMENTS

<table>
<thead>
<tr>
<th>Minimum Credit Requirement</th>
<th>51 credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Residence Credit Requirement</td>
<td>32 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework Requirement</td>
<td>Half of degree coursework (26 credits out of 51 total credits) must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university's Course Guide.</td>
</tr>
<tr>
<td>Overall</td>
<td>3.00 GPA required.</td>
</tr>
<tr>
<td>Graduate GPA Requirement</td>
<td>Students must earn a B or above in all major coursework.</td>
</tr>
<tr>
<td>Other Grade Requirements</td>
<td>No language requirements.</td>
</tr>
<tr>
<td>Assessments and Examinations</td>
<td>After the committee is chosen, the student must submit certification paperwork that details the intended coursework plan, the committee members' names and signatures, a short explanation of why they were chosen and an appended research plan. Certification plans will be reviewed and approved by the program academic committee. Students are expected to meet with their committee at least once per year until degree completion. There are two preliminary examinations. The first (A) consists of a take-home exam of questions authored by the student's dissertation committee, followed by an oral exam. The student may retake the exam once if they fail on the first attempt. The second preliminary examination (B) requires that the student write their research plan in the form of a major grant application and defend it orally before the committee. Candidates must present broad-based evidence of general proficiency in research and the ability to conduct independent investigation as demonstrated in a written dissertation presenting original research. A final public presentation, followed by an oral exam in front of their committee and official deposit of the dissertation with the Graduate School is required.</td>
</tr>
<tr>
<td>Language Requirements</td>
<td>A minor is no longer required but may be completed by students who wish to receive one. The decision to fulfill a minor should be requested at the time of certification. In general, most minors require a minimum of 10 didactic credits in a single degree program (e.g., neuroscience, population health, genetics). Focused minors usually require approval from the related program or department and may involve additional rules or credits. Check with the program in which you have an interest early in the process.</td>
</tr>
</tbody>
</table>

REQUIRED COURSES

Choose your coursework in consultation with your major professor. The Graduate School requires a minimum of 32 total credits prior to taking the CBMS prelim B and 51 credits to graduate (any combination of didactic or lab courses, seminars and research).

- 20 didactic credits. Nine credits of advanced coursework, or MS/DVM coursework or equivalent, may be transferred as approved by your thesis committee and the Academic Committee, provided they are defined as graduate level. Nine credits may be transferred from coursework taken as a Special Student at UW-Madison if the student pays the difference in tuition for the terms in question and the course is numbered 700 and above. A maximum of 7 undergraduate credits may be transferred only from UW-Madison. In all cases, these credits will not count toward the 50% minimum unless courses are graduate level (700 level and above).
- 2 PATH-BIO 930 Advanced Seminar one-credit student seminar courses.
- For students who enter fall 2016 or later: PhD students must register for four semesters of PATH-BIO 930 Advanced Seminar and present twice after the first two semesters. One presentation must be completed prior to passing to dissertation status. The second presentation may take place after reaching dissertation status, but no later than the semester prior to the student's dissertation defense. PhD students will take the course P/S/U (Progress/Satisfactory/Unsatisfactory) unless they are presenting.
- 28 Research 990 credits (minimum, unless you take more didactic or laboratory courses)
- Certification submitted and approved by thesis committee and Academic Committee
- Pass preliminary examinations A and B
- Completed dissertation composed of original work approved by your major professor and committee based on original research, defended before your committee and deposited with the Graduate School.

Approved and Recommended Courses

The following is a list of core courses taken by many students and recommended courses that are appropriate to specific research areas. These courses are suggestions only; the student and their committee ultimately decide the best coursework plan for each student’s specific program, with final approval from the program’s academic committee. Students are responsible for determining that the coursework chosen meets the Graduate School’s criteria for graduate work.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SURG SCI 812</td>
<td>Research Ethics and Career Development</td>
<td>2</td>
</tr>
<tr>
<td>Any other science-based ethics course</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Core Courses

These courses are chosen by many students to fulfill their major coursework plan

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENETICS 466</td>
<td>Principles of Genetics</td>
<td>3</td>
</tr>
<tr>
<td>PATH-BIO/HORT 500</td>
<td>Molecular Biology Techniques</td>
<td>3</td>
</tr>
<tr>
<td>PATH-BIO/HORT M M &amp; I 773</td>
<td>Eukaryotic Microbial Pathogenesis</td>
<td>3</td>
</tr>
<tr>
<td>BIOCHEM 501</td>
<td>Introduction to Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>BIOCHEM/GENETICS/MICROBIO 612</td>
<td>Prokaryotic Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOCHEM/GENETICS/MD GENET 620</td>
<td>Eukaryotic Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOCHEM/PHMCOL/M/ZOOLOGY 630</td>
<td>Cellular Signal Transduction</td>
<td>3</td>
</tr>
<tr>
<td>ZOOLOGY 570</td>
<td>Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td>PATH 750</td>
<td>Cellular and Molecular Biology/Pathology</td>
<td>2-3</td>
</tr>
<tr>
<td>PATH 751</td>
<td>Cell and Molecular Biology of Aging</td>
<td>3</td>
</tr>
<tr>
<td>STAT/F&amp;W ECOL/HORT 571 &amp; STAT/F&amp;W ECOL/HORT 572</td>
<td>Statistical Methods for Bioscience I and Statistical Methods for Bioscience II</td>
<td>8</td>
</tr>
</tbody>
</table>

**Courses from which Students Build Disciplinary Strength**

**Epidemiology**

- PATH-BIO 512 Introduction to Veterinary Epidemiology 2
- POP HLTH/SOC 797 Introduction to Epidemiology 3
- POP HLTH 802 Advanced Epidemiology: Etiology and Prevention 3

**Physiology**

- AN SCI/DY SCI 434 Reproductive Physiology 3
- COMP BIO 551 Veterinary Physiology A 4
- COMP BIO 506 Veterinary Physiology B (spring) 4
- ZOOLOGY 611 Comparative and Evolutionary Physiology 3
- ZOOLOGY/AN SCI/OBS&GYN 954 Seminar in Endocrinology-Reproductive Physiology 1

**Infectious Disease and Immunology**

- M M & I 701 Infection and Immunity I 4
- PATH-BIO 510 Veterinary Immunology 3
- PATH-BIO 513 Veterinary Virology 2
- PATH-BIO 514 Veterinary Parasitology 3
- PATH-BIO 517 Veterinary Bacteriology and Mycology 4
- PATH-BIO/M M & I/MICROBIO 528 Immunology 3
- PATH-BIO/M M & I 750 Host-Parasite Relationships in Vertebrate Viral Disease 3
- PATH-BIO/M M & I 773 Eukaryotic Microbial Pathogenesis 3
- M M & I/PATH-BIO 720 Advanced Immunology, Critical Thinking 3
- M M & I/MICROBIO/PATH-BIO 790 Immunology of Infectious Disease 3

**Neuroscience**

- COMP BIO 505 Veterinary Neuroanatomy and Neurophysiology 3
- ZOOLOGY/PSYCH 523 Neurobiology 3
- NTP/NEURODPT 610 Cellular and Molecular Neuroscience 4
- NTP/NEURODPT/PSYCH 611 Systems Neuroscience 4

**Toxicology and Pharmacology**

- PATH-BIO 555 Veterinary Toxicology 2
- PATH/M&ENVTOX/MEDICINE/ONCOLOGY/PHM SCI/PHMCOL-M/POP HLTH 625 Toxicology I 3
- PATH/M&ENVTOX/MEDICINE/PHM SCI/PHMCOL-M/POP HLTH 626 Toxicology II 3
- ONCOLOGY 675 Advanced or Special Topics in Cancer Research 1-3
- ONCOLOGY 703 Carcinogenesis and Tumor Cell Biology 3

**Virology**

- PATH-BIO 513 Veterinary Virology 2
- BIOCHEM/M M & I 575 Biology of Viruses 2
- ONCOLOGY/MICROBIO/PL PATH 640 General Virology-Multiplication of Viruses 3
- M M & I/PATH-BIO 750 Host-Parasite Relationships in Vertebrate Viral Disease 3

**Policies**

**GRADUATE SCHOOL POLICIES**

The Graduate School’s Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

**MAJOR-SPECIFIC POLICIES**

**GRADUATE PROGRAM HANDBOOK**

The Graduate Program Handbook (https://www.vetmed.wisc.edu/ms-phd/current-students/documents-and-forms) is the repository for all of the program’s policies and requirements.

**PRIOR COURSEWORK**

**Graduate Work from Other Institutions**

With program approval, students may transfer no more than 9 credits of advanced graduate coursework from other institutions. These courses may not be used toward the Graduate School’s Minimum Graduate Residence Credit. Coursework earned ten or more years prior to admission to the doctoral degree is not allowed to satisfy requirements.

**UW–Madison Undergraduate**

With program approval, students may count up to 7 credits of advanced undergraduate coursework taken at UW–Madison in lieu of or in combination with credits transferred from another institution.
Comparative Biomedical Sciences, Ph.D.

institution. These courses must meet the Graduate School’s criteria as graduate coursework and may not be used toward the 50% graduate coursework requirement unless taken at the 700 level or above.

UW–Madison University Special
With program approval, students may count up to 9 credits of coursework numbered 400 or above taken as a UW–Madison special student in lieu of or in combination with credits transferred from another institution or as a UW–Madison undergraduate. Coursework taken as a University Special student would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. Coursework earned ten or more years prior to admission to the doctoral degree is not allowed to satisfy requirements.

PROBATION
A semester GPA below 3.0 will result in the student being placed on academic probation. If a semester GPA of 3.0 is not attained during the subsequent semester of full or part-time enrollment the student may be dismissed from the program or allowed to continue based on advisor appeal to the Graduate School.

ADVISOR / COMMITTEE
All students must have an advisor prior to final admission unless offered a rotation. A dissertation committee consisting of five members, the advisor plus two program trainers and two outside members, must be chosen by the end of the first year. The fifth member may be a scientist, industry expert, or member of the faculty from another institution. All committee members of your final oral examination committee will be designated as readers.

CREDITS PER TERM ALLOWED
15 credits

TIME CONSTRAINTS
Certification should be completed by the end of the first year of enrollment.

Preliminary examination A should be taken by the end of the second year.

Preliminary examination B should be taken by the end of the third year.

A candidate for a doctoral degree who fails to take the final oral examination and deposit the dissertation within five years after passing preliminary examination B may be required to take another preliminary examination to be admitted to candidacy a second time.

Doctoral degree students who have been absent for ten or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements, but that coursework may not count toward Graduate School credit requirements.

OTHER
Most students must be accepted by a major professor in the CBMS Graduate Program before they can be fully admitted to the program.

Rotations are offered to a limited number of entering students (1–2) in the fall semester.

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES
Take advantage of the Graduate School’s professional development resources (https://grad.wisc.edu/pd) to build skills, thrive academically, and launch your career.

LEARNING OUTCOMES
1. Articulates, critiques, or elaborates the theories, research methods, and approaches to inquiry and/or schools of practice in the field of study.
2. Articulates sources and assembles evidence pertaining to questions or challenges in the field of study.
3. Assesses and/or applies methodologies and practices in the field of study.
4. Articulates challenges involved in practicing the field of study, elucidates its leading edges, and delineates its current limits with respect to theory, knowledge, and/or practice.
5. Appreciates the implication of the primary field of study in terms of challenges, trends, and developments in a broader scientific context.
6. Initiates, assembles, arranges and/or reformulates ideas, concepts, designs, and/or techniques in carrying out a project beyond conventional boundaries.
7. Engages diverse cultural, historical or scientific perspectives and articulates how these perspectives contribute to a project, paper or performance.
8. Demonstrates abilities to apply knowledge through critical thinking, inquiry, and analysis to solve problems, engage in scholarly work, and/or produce creative products.
9. Evaluates, assesses or refines information resources or an information base within the field.
10. Communicates clearly in styles appropriate to the field of study.
11. Develops hypothesis, creates research, scholarship or performance that makes a substantive contribution to the field of study.
12. Demonstrates breadth within their learning experiences.
13. Implements methodologies and/or practices to test hypotheses and illustrates the implications of the experimental outcome to the field of study and its relationship to allied fields.
14. Develops new concepts and methodologies and/or identifies new research opportunities.
15. Communicates complex and/or ambiguous ideas clearly.
16. Evaluates the implications of one’s own scholarship/research/ performance to broader scientific advancement.
17. Recognizes and applies ethical conduct and professional guidelines.
18. Fosters ethical conduct and professional guidelines.

**PEOPLE**

**Faculty:** See Comparative Biomedical Sciences (http://www.vetmed.wisc.edu/ms-phd/current-students/faculty-trainers) faculty list.