

C. Department of Animal and Food Sciences: Non-thesis Masters Degree Option: Veterinary Biosciences, Biotechnology, and One Health (VBBOH)

1. Rationale and Purpose of Program

Many students that finish a pre-Veterinary or pre-Medical course of study at the University of Delaware, do so without rigorous technical training in pathogen-host interactions, metabolic disorders, or the connection of nutrition to host immunity and health. For those who are not directly competitive for direct matriculation into professional programs, industrial research positions or graduate school, we plan a two-year, non-thesis Masters in Veterinary Biosciences, Biotechnology, and One Health (VBBOH). We broadly define One Health as the interactions of hosts, pathogens, their nutrition and their environment. This program is designed to provide hands-on technical training, as well as extensive theoretical training in host-pathogen, -nutrition, and -metabolic interactions. The Department of Animal & Food Sciences offers B.S. degrees in Animal Biosciences, Animal Science, Food Science and Pre-veterinary Medicine. We anticipate that a new, hands-on, more technically-focused non-thesis Masters in Veterinary Biosciences, Biotechnology, and One Health will serve the needs of multiple groups of individuals.

First, we have a successful pre-veterinary and animal biosciences (PV, AB) program that consistently places 85%+ of our undergraduates that apply for admission into Veterinary Schools. Almost all students who are not accepted to Veterinary School on their first attempt, continue to apply a second, or even third time. Thus, gaining more educational experience and showing an ability to excel in graduate level courses readily assists these students during their subsequent applications.

Second, graduates that major in animal science and who are interested in pursuing careers in animal health and pharmaceutical research may see that a non-thesis option can provide them with tools and skills for pursuing this career path.

Third, there are individuals in the workplace regionally that seek additional training that can be used to enhance their core competencies in a rapidly-evolving job market. The non-thesis Masters degree in Veterinary Biosciences, Biotechnology, and One Health (VBBOH) can contribute to the marketability of these individuals and is not automatically a terminal degree.

Students completing the VBBOH non-thesis option will:

1. Expand their knowledge and skills in fundamental host-pathogen interactions, nutrition, and immunology.
2. Acquire hands-on technical training in cell and molecular biology techniques as they relate to basic research, diagnostic, and clinical applications.
3. Acquire training in experimental design and data analysis.

2. Date of Permanent Status

The non-thesis Masters is scheduled to start in Spring, 2019, upon approval by the Faculty Senate.

3. Admission Requirements

Applicants must submit all materials directly to the University Office of Graduate and Professional Education using the online admission process before admission can be considered. Admission applications are available at: <https://grad-admission.udel.edu/apply/>

On a 4.0 system, a G.P.A. of at least 3.0 is preferred. Applications will be evaluated based on a combination of record of academic or professional achievement, 3 letters of recommendations, and a personal statement describing how the completion of the Masters in Veterinary Biosciences, Biotechnology, and One Health will contribute to their professional goals. Applicants must take the GRE Aptitude Test and should have a minimum of 300 combined on verbal and quantitative reasoning. Students for whom English is not their first language, an official TOEFL score of at least 100 is required (on the iBT), with a minimum speaking score of 18. TOEFL scores greater than two years old cannot be considered to be official.

Admission to the Masters in Veterinary Biosciences, Biotechnology, and One Health (VBBOH) is based on selections made by the department graduate committee in compliance with University policies and procedures. Admission is selective and competitive and is dependent on the number of well-qualified applicants, the number of available faculty to serve as mentors, and facilities. Those who meet stated minimum academic requirements are

not guaranteed admission, nor are those who fail to meet those requirements necessarily precluded from admission, if they offer other appropriate strengths and/or experience.

4. Academic Preparation Requirements

A Bachelor's degree from an accredited program, preferably from a curriculum based on biological sciences (e.g., but not limited to, Animal Science, Food Science, Biology, Nutrition, Physiology, Genetics, Microbiology, Chemistry, Biochemistry, or another appropriate discipline) is required for admission.

5. Application Deadlines

Applications will be taken on a continuing basis to allow for admittance in either the Fall, Spring, or Summer Semesters. The deadlines for each semester are given below. Note: International applicant deadlines precede Domestic US citizen applicants, due to additional timing requirements for obtaining an appropriate student VISA.

- Fall:** June 1 (International applicants)
August 1 (Domestic applicants, US citizens)
- Spring:** December 15 (International applicants)
January 15 (Domestic applicants, US citizens)
- Summer:** April 15 (International applicants)
May 15 (Domestic applicants, US citizens)

6. Types of Admission

Admission to the graduate program is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of those requirements necessarily precluded from admission if they offer other appropriate strengths.

- A. Regular Admission:** Regular status is offered to students who meet all of the established entrance requirements.
- B. Conditional Admission:** Successful applicants are typically admitted conditionally because stated information is self-reported and uploaded documents are unofficial. Fulfilling the conditions stated on an offer of conditional admission by the first date

of graduate coursework is critical, so the instructions stated on the letter must be followed carefully. Failure to clear all stated conditions by the start of graduate coursework may result in revocation of admission to the graduate program.

7. Degree Requirements

The Veterinary Biosciences, Biotechnology, and One Health non-thesis M.S. is intended for applicants who want to further their academic training in host-pathogen interactions, are research-oriented, but may lack hands-on training. Alternatively, they may come from an industry background and want to increase their skills and understanding, while not being able to commit to a full-time, thesis-requiring graduate program. This non-thesis degree requires satisfactory completion of a minimum of 30 hours of graduate-level coursework composed of:

- A. Host-Pathogen Core: 9 credit hours (cr hrs) minimum, 3 cr hrs being taken within ANFS
- B. Nutrition/Immunology Core: 6 cr hrs, 3 cr hrs being taken within ANFS
- C. Technical and Practical Training: (9 cr hrs, 3 cr hrs being taken within ANFS
- D. Research Training and Data Analysis: 3 cr hrs
- E. Individual Research Experience: 3 cr hrs of ANFS648

8. Course Requirements

A. Host-Pathogen Core (9 cr. hrs.)

Essential to an understanding of the concept of One Health is knowledge of host-pathogen interactions in the context of their environment. The Host-Pathogen Interactions Core is a total of 9 credit hours of graduate-level courses, of which 3 credit hours must be from an ANFS course. Courses meeting these requirements are given, below:

College	Department	Course #	Course Title
CANR	ANFS	633	Poultry Pathology
CANR	ANFS	635	Animal Virology
CANR	ANFS	640	Comparative Histopathology
CANR	ENWE	610	Medical, Veterinary & Forensic Entomology
CANR	ENWE	611	Insect Pest Management
CAS	BISC	625	Cancer Biology
CAS	BISC	668	Biochemistry of Disease
CAS	BISC	682	Bacterial Pathogenesis

B. Nutrition and Immunology Core (6 cr. hrs.)

Essential for an understanding of the concept of One Health is knowledge of how nutrition informs and shapes host immune processes. This core is composed of 6 cr hrs of graduate-level courses, 3 cr hrs of which must be from ANFS. Courses meeting these requirements are given, below:

College	Department	Course #	Course Title
CANR	ANFS	636	Immunology of Domestic Animals
CANR	ANFS	637	Avian Immunology
CANR	ANFS	654	Advanced Ruminant Nutrition
CANR	ANFS	655	The Gut Microbiome
CAS	NSCI	640	The Immune System & Behavior

Additional courses may meet this requirement, as they may be developed by new faculty.

C. Technical and Practical Training (9 cr. hrs.)

This core requires the acquiring of real-world, hands-on skills for accomplishing research tasks. The Technical and Practical Training Core is a total of a minimum of 9 credit hours of graduate-level courses, of which 3 credit hours must be from an ANFS course. Courses providing these skills are given in the table, below:

College	Department	Course #	Course Title
CANR	ANFS	644	Bioinformatics
CANR	ANFS	650	Applied Biomedical Communications
CANR	ANFS	651	Emergency Animal Management
CANR	ANFS	671	Paradigms in Cell Signaling
CANR	APEC	603	Simulation Model. & Analysis
CAS	BISC	805	Multidisciplinary Biotechnology
CAS	BISC	811	Adv. Microbiology
CAS	BISC	816	Systems Biology of Cells...
COE	BINF	644	Bioinformatics
COE	BINF	650	Protein Modifications
COE	BINF	694	Systems Biology I
CAS	CHEM	624	Principles of Mass Spectrometry
CAS	CHEM	627	Practical Mass Spectrometry
CAS	CHEM	645	Protein Structure and Function
CAS	CHEM	646	DNA-Protein Interactions
CENG	BMEG	679	Introduction to Medical Imaging Systems
HESC	MEDT	603	Research Design

HESC	MEDT	608	Molecular Prep. Techniques
HESC	MEDT	625	Basic Molecular Techniques
HESC	MEDT	626	Protein Purification and Characterization
HESC	MEDT	627	Flow Cytometry
HESC	MEDT	635	Practical Genomics, Proteomics & Bioinformatics
HESC	MEDT	640	Adv. Nanomedicine
HESC	MEDT	651	Cell and Tissue Culture Techniques
HESC	MEDT	660	Adv. Tech. in Nanomedicine
HESC	MEDT	691	Molecular Diagnostics
HESC	MEDT	692	Applications of Molecular Diagnostic Techniques

D. Research Training and Data Analysis (3 cr hrs)

This core requires the learning of approaches to statistical analysis of biologically-derived data. Courses providing these skills are given in the table, below, but are subject to additions should appropriate courses become available:

College	Department	Course #	Course Title
CANR	APEC	608	Research Methods
CANR	APEC	806*	Research Techniques and Procedures
CAS	BISC	643	Biological data analysis
CAS	STAT	656	Biostatistics

* - requires a prior statistics course

E. Individual Research Experience (3 cr hrs, in ANFS)

During the final semester of study, students must participate in a laboratory research experience at the ANFS 668 level. This experience is designed to provide a real-world application of the techniques and concepts developed during the course work. This course will be developed in conjunction with a participating faculty member and will require both written and practical evaluation.

9. Advising

Students accepted into the Masters in Veterinary Biosciences, Biotechnology and One Health will be assigned an advisor. The student has the responsibility to meet with their advisor to plan their course of study and schedule their research experience in the program. Advice will be given concerning course selection based on interests and undergraduate/graduate background. Our program is sufficiently small that we are able to give individualized attention to graduate students.

10. Transfer Credits

With approval of the Chair who renders a decision after consultation with the Graduate Committee and relevant faculty, and if necessary, in consultation with the department that offers the (potentially) equivalent course, up to 9 credits may be recommended to the Office of Graduate and Professional Education to be transferred to apply to the degree provided that the credits have not been applied to obtain a different degree (i.e., bachelor's degree or completed graduate degree elsewhere).

Transfer of Graduate Credit Earned at another University (Official Transcript Required)

- Credits used to complete other degrees may not be transferred into a degree at UD.
- Maximum of 9 credits earned at another U.S. institution may be applied to a graduate degree if not used to complete a previous degree.
- Grade must be "B" or better to be acceptable for transfer. Course completion date must be no older than 5 years.
- Credits but no grades or quality points will transfer.
- Credits from institutions outside the United States are not transferable to the University of Delaware unless permission to transfer is given by Office of Graduate and Professional Education.

11. Degree Progress

A. Academic load and progress

The Masters in Veterinary Biosciences, Biotechnology, and One Health will follow the University of Delaware, Office of Graduate and Professional Education recommended policy for determining students' failure to make satisfactory progress towards degree requirements and time limits for completion. Students may be enrolled on a full-time (9 credits per term) or part-time (minimum of 6 credits) basis.

B. Grade and GPA requirements

Students must have a minimum overall cumulative grade point average of 3.0 to be eligible for the degree. In addition, the grades in courses specifically required for the degree program must average at least 3.0. All graduate-numbered courses taken with graduate student classification at the University of Delaware are applied to the cumulative index. *Credit hours and courses for which the grade is below "C- "or below do not count toward the degree, even though the grade is applied to the index. Students with GPAs falling below a 3.0 will be dismissed from the program.*

C. Academic Probation

The Office of Graduate Studies monitors the academic progress of all graduate students and notifies students in writing of all academic deficiencies. The cumulative GPA after each 9-hour increment determines academic standing. In addition to the University policy regarding minimum grade point averages, some departments require graduate students to maintain certain performance minima in their programs of study in all or in particular courses. Failure to meet the stated minima may lead to academic dismissal from the program.

12. Financial aid

There are no financial awards for this degree, this is a tuition-financed program.