

**University of Delaware**

**MICROBIOLOGY GRADUATE PROGRAM**

**ACADEMIC PROGRAM APPLICATION**

**NOVEMBER 2018**

**PROGRAM POLICY STATEMENT**

## PROGRAM HISTORY

### **A. Statement of purpose, expectation of graduate study and rationale and demand.**

*Earth is microbial:* Bacteria, archaea, viruses, protists, and fungi are the largest store of biomass on the planet, and represent nearly all of its biodiversity. They store massive genetic resources that can be used to solve challenges faced by our rapidly growing human population. Microbes will be key to developing more sustainable energy generation and material synthesis, improving human health and wellness, and satisfying increased food demands of larger human populations in the face of limited environmental resources. The faculty of the University of Delaware (UD) Microbiology Graduate Program are already addressing these challenges in five separate colleges and thirteen departments. By bringing these faculty and resources together to train the next generation of microbiologists, with stakeholder guidance to develop an innovative educational program, the Microbiology Graduate Program will serve as a model for interdisciplinary enterprises at UD.

Our faculty are already making significant contributions to the Grand Challenges outlined in *Delaware Will Shine*, the blueprint for UD's continued development as a premier learner-centered university. The program faculty and students are engaged in the Grand Challenges in *Improving Health and Wellness*, *Innovating Energy and Environmental Solutions*, and *Ensuring Safety and Security*. Furthermore, the activities of the program and its interdisciplinary nature will contribute to our *Welcoming and Collaborative Campus Community*, *Innovative Educational Design*, and *Multidisciplinary Research and Scholarship*, and *Community Engagement*, three of the strategic initiatives detailed in *Delaware Will Shine*.

#### ***The goals of this graduate program are to:***

- Recruit and retain a diverse pool of high-quality graduate students in Microbiology
- Recruit and retain diverse, high-quality Microbiology faculty invested in cutting-edge student training
- Rigorously deliver foundational concepts in genome-enabled Microbiology via a core curriculum
- Provide rigorous electives to support broad exploration beyond the core curriculum
- Foster professional skills in trainees, enabling them to succeed in multiple career paths
- Facilitate cross-departmental and cross-college research collaborations

- Identify and develop new tracks/concentrations as suggested by student/stakeholder interest
- Proactively engage the advisory committee (see below) to assess program goals, curriculum, and to generate external support.

### ***Rationale and Demand for this graduate program***

Graduate students engaged in microbiology research at the University of Delaware currently receive MS or PhD degrees conferred by Biological Sciences, Chemistry and Biochemistry, Marine Biosciences, Geological Sciences, Plant and Soil Sciences, Animal and Food Sciences, Chemical and Biomolecular Engineering, Civil Engineering, Medical and Molecular Sciences, or several other departments. These degrees need to better reflect the students' achievements in and contributions to the field of microbiology. Over 40 faculty with expertise in microbiology have formed a community of microbiologists that encompasses five colleges and 14 departments. The proposed MS and PhD programs in Microbiology will build on this foundation, support inter-departmental research and education, and prepare students for careers that address fundamental challenges of the 21<sup>st</sup> century. The rationales for the proposed MS and Ph.D. degree programs in Microbiology are:

- Microbiology is essential to 21<sup>st</sup> century careers in science and engineering. The Grand Challenges facing society today include managing the nitrogen cycle, sequestering carbon, engineering better medicines, and advancing solar capture technology (<http://www.engineeringchallenges.org/challenges.aspx>). Microbes are fundamental to these processes in both natural and engineered systems, and scientists and engineers trained in microbiology will be critical to meeting these challenges.
- The program will build upon existing research in environmental microbiology and molecular microbiology at the University of Delaware, and will leverage these programs to build research strength in medical microbiology.
- The program will build on existing educational resources at UD and bring together a critical mass of students for creative educational programs in environmental, medical, and applied microbiology.
- The program will enhance recruitment of excellent students from Microbiology BS and BA programs nationwide. This in turn will improve recruitment and retention of microbiology faculty across campus, including the colleges of Arts & Sciences, Agriculture & Natural Resources, Engineering, Earth, Ocean & Environment, and Health Sciences.
- The program will encourage cross-departmental interactions, promoting existing collaborations and providing opportunities for development of new collaborations.

- The program will provide a foundation for educational funding and training grants.
- The program will contribute to the University of Delaware's strategic initiatives in Life and Health Science, Energy and Environment, and Global Engagement.

## **INSTITUTIONAL FACTORS**

- 1. Alignment with strategic priorities.** A graduate program in microbiology will contribute to both the educational and research missions of the university. Students will obtain “scientific, humanistic, and social knowledge for the benefit of the larger society”; these students will be prepared to use this knowledge to solve challenges in environmental, medical, and engineered systems on local to international scales.
- 2. Impact on other university programs.** This program will build on the strengths of existing programs and provide new educational opportunities.
  - The program will offer graduate credentials in a classical discipline that underlies many of the scientific challenges of the 21<sup>st</sup> century;
  - Courses developed as part of this program can be used as electives in current graduate programs, providing additional course content in a variety of degree programs;
  - Graduate students with scientific expertise in microbiology will be able to collaborate not only with microbiologists across campus, but also with interdisciplinary teams with needs for microbiology experience;
  - The existence of an established graduate program along with a strong history of collaboration will make the University of Delaware competitive for both training grants and center research grants.
- 3. Utilization of existing university resources.** Faculty engaged in microbiology research can be found in the colleges of Agriculture & Natural Resources, Arts & Sciences, Earth, Ocean & Environment, Engineering, and Health Sciences. These faculty have fully equipped research laboratories and collaborate with a variety of core facilities at the university, including the Bioinformatics Core, BioImaging Center, NMR facility, Sequencing and Genotyping Center, Advanced Materials Characterization Lab, Soil Testing Facility, and Nanofabrication Facility. The proposed Microbiology Graduate Program builds on the strength of the existing research programs. Faculty with research in microbiology have already been identified. These faculty have listed their existing courses as electives for the Microbiology Graduate

Program. Any of them will be eligible to serve as primary advisors or committee members for any student in the program.

## STUDENT DEMAND

**1. Enrollment projections.** We expect that 4-6 new students will enter this program each year. The number of students accepted will depend on the number of faculty able to provide graduate assistantships beyond the first year.

**Access to graduate and professional programs.** The graduates of the Ph.D. program in Microbiology Graduate program will complete the program prepared to pursue careers in research, education, or development in academia, medicine, industry, or government agencies. Representatives of each of these sectors will be invited to serve on the program's External Advisory Board, and will be asked to recommend or lead professional development workshops for students interested in these fields. Since ~2/3 of the full-time microbiology jobs posted on indeed.com are for positions outside of academia, these professional development opportunities will be an important component of the program.

**2. Demand and employment factors.** Data from the National Center for Education Statistics shows that more than 2600 Bachelor's degrees in Microbiology were awarded in 2017 ([https://nces.ed.gov/programs/digest/d17/tables/dt17\\_318.30.asp](https://nces.ed.gov/programs/digest/d17/tables/dt17_318.30.asp), Table 318.30). The Bureau of Labor Statistics predicts that the number of jobs in the field of microbiology will increase ~8% over the next ten years. Microbiologists are critical team members in industrial microbiology (bioproduction), biopharmaceuticals, bioremediation of contaminants, human health care, veterinary medicine, food safety, and water and wastewater treatment and management, among others. Because microbiology is so important to these fields, their expertise is also valuable to regulatory agencies, departments of natural resources, and departments of health and human services. Graduates of this program will obtain both a broad overview of microbial physiology, microbial genetics and genomics, and a deep understanding in a microbiological sub-field. This education will make them competitive for employment in a variety of jobs.

**3. Regional, state, and national factors.** In the Mid-Atlantic region, roughly from Virginia to New York City, there is an active need for microbiology-trained personnel in biotechnology research, industry, and government, as well as at universities. Other universities in this region have graduate degree programs in

Microbiology, including the University of Pennsylvania, Drexel University, Temple University, University of Maryland-Baltimore County, and University of Maryland (Main Campus). However, all of these programs focus heavily on medical microbiology or microbiology as it relates to the human body. The University of Delaware has strengths in environmental microbiology, agricultural microbiology, and microbiology of engineered systems that make us unique in the region.

## **B. Date of Permanent Status (or current status).**

We anticipate recruiting admitting the first cohort of students during the Spring of 2019, to matriculate in Fall 2019.

## **C. Degrees offered**

The program will offer two degrees, an **M.S. and Ph.D.**, in four areas of study:

- ***Environmental Microbiology***: This track includes geobiology, microbial ecology of non-host environments, biogeochemistry, and viral ecology.
- ***Host-Microbe Interactions***: This track includes host-associated microbiomes, microbial ecology of host-associated environments, pathogenesis, immunology, and virology.
- ***Applied Microbiology***: This track includes bioremediation, biopharmaceuticals, microbial fermentation, food microbiology, and industrial microbiology.
- ***Microbial Physiology and Genetics***: This track includes systems biology, microbial biochemistry, metabolism, and gene regulation.

### **Learning Goals/Key Competencies:**

**M.S.** We expect M.S. graduates to

- Critically analyze the primary literature
- Accurately perform complex experimental designs based on the primary literature
- Analyze quantitative and bioinformatic microbiology data
- Compellingly present results of experiments in both oral and written formats

**Ph.D.** In addition to the skills of an M.S., we expect Ph.D. graduates to

- Identify knowledge gaps in their track/concentration

- Design and implement research programs that creatively address these knowledge gaps
- Develop and demonstrate teaching skills (these include, but are not limited to, a TA-ship in a classroom or laboratory setting; designing and developing teaching aids like audiovisual packages for classroom use; designing and implementing one or more lab experiments for a course; guest lecturing)

## **II. Admission**

### **A. Admission Requirements**

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.

To officially apply for admission, see <http://www.udel.edu/gradoffice/apply/> for detailed instructions, web-based forms, and contact information. To be admitted to the graduate program, applicants should meet the following requirements:

- A completed University of Delaware Graduate Studies application. In the application, prospective students should indicate clearly whether they are applying for the MS or the Ph.D. program.
- A personal statement is required in the Graduate Studies application, and should discuss the following questions:
  - What is your prior research experience (for credit, as an intern, as a job, or any other practical or industry-related experiences)?
  - What are your specific research and educational goals?
  - What are your long-term professional career objectives?
  - How do you see this program assisting you with achieving your objectives?
- Graduate Record Examination Scores are not required for domestic applicants. Subject GRE scores are not required.
- Official, up-to-date transcripts of all undergraduate and graduate programs. A minimum of 3.0/4.0 is required in the major.

- Three letters of recommendation from individuals with knowledge of the applicant's research experience, academic preparation and potential ability as a graduate student.
- International students must take the Test of English as a Foreign Language (TOEFL) (Minimum Score: 550 paper test, 79 on Internet-based tests) TOEFL scores more than two years old cannot be considered official.
- Interview with one or more faculty members of the Microbiology program including but not limited to the potential major advisor. Interviews should be conducted in person for domestic applicants and via Skype or other video-based call for international applicants.

## **B. Prior degree requirements**

Applicants should have a BA or BS in Microbiology or a related field, and as part of their undergraduate training, should have completed the following (or the equivalent): two years of biological sciences; one year of mathematics, preferably including calculus and/or statistics; one semester of college physics; one year of general chemistry; and at least one semester of organic chemistry. Other applicants will be considered if they have strong academic backgrounds in other scientific areas. Provisional admission may be offered with the stipulation that any deficiency in undergraduate training be made up (without graduate credit) during the first year of graduate study.

### Change of Classification and Transfer Students

Students that are currently matriculated in other degree programs should complete a "Change of Classification" Form to seek approval to be admitted into the Microbiology Program. The Program Committee will evaluate the change in classification and transfer requests on a case-by case basis to determine if the applicant will need to complete a full application form submitted to the Office of Graduate and Professional Education. All transfer students will still have to meet the requirements listed above.

## **C. Application deadlines**

Applications normally are considered only for fall entrance. International applicants are considered only for fall admission. To ensure optimum consideration for fall admission, complete applications should be received at this university by January 15 with a final deadline of April 15. Evaluation of applications will begin on January 15, and applications received between January 15 and April 15 will be considered only if unfilled slots remain.

## D. Special competencies needed

Applicants should provide evidence of research experience (academic or otherwise) in their personal statement and on their curriculum vita. Applicants with prior research experience will receive priority consideration.

## III. Academic

### A. Degree Requirements

#### A.1. Course requirements summary

MS students are required to take 8 credits from the core curriculum (7 course credits plus 1 seminar credit), 12 credits chosen from the electives relevant to their concentrations, 4 research credits and 6 thesis credits, for a total of 30 credits.

<b>MS in Microbiology</b>	<b>No. of credits</b>
Core courses	7
Seminar	1
Elective courses	12
Research credits	4
Thesis credits	6
<b>Total credits</b>	<b>30</b>

PhD students are required to take 12 credits from the core curriculum (9 course credits plus 3 seminar credits), 15 credits chosen from the electives relevant to their concentrations, and 9 dissertation credits, for a total of 42 credits.

<b>PhD in Microbiology</b>	<b>No. of credits</b>
Core courses	9
Seminar	3
Elective courses	15
Research credits	6

Dissertation credits	9
<b>Total credits</b>	<b>42</b>

## A.2. Curriculum

- Core Courses

*Microbial Physiology and Diversity (MAST625; 3 credits)*: Microbial growth and composition, cell architecture and structures, energy metabolism, diversity in energy and assimilatory metabolism.

*Microbial Genetics and Genomics (MAST626; 3 credits)*: Central dogma, genetic techniques, gene regulation, genome structure and function, -omics, focus on archaea, bacteria and viruses.

*Current Topics in Microbiology: Seminar (PLSC811, 1X for M.S. [1 credit] 3X for Ph.D. [3credits])*: Exposure to the breadth of research including microbiology from external and internal speakers; required presentation on the student's research project will foster oral communication and professional development.

*Microbiology Journal Club (BISC850, 1X for M.S. [1 credit] 3X for Ph.D. [3 credits])*: Develop critical literature analysis skills and discussion practices; requirement to present a paper will foster oral communication skills.

Laboratory Rotation (Ph.D. only): Acquisition of laboratory skills and selection of advisor through three laboratory rotations.

### b. Elective Courses

A range of electives is available based on the teaching activities of Microbiology program faculty. To be included as an elective in the Microbiology graduate program, a course will have to be 600-level or higher and be approved after a review of the syllabus by the Program Director and Faculty Steering Committee.

Areas of Study	Course Number	Course Title
<b>Environmental Microbiology</b>	CIEG644	Microbiology of Engineered Systems

	MAST645/GEOL645	Geomicrobiology
	MAST616	Methods in Molecular Biology
	MAST634	Marine Molecular Science
	PLSC619	Soil Microbiology
<b>Host-Microbe Interactions</b>	ANFS655	Gut Microbiome
	ANFS635	Animal Virology
	ANFS671	Paradigms in Cell Signaling
	BISC850	Advanced Topics in Biology: Host-pathogen Interactions
	MAST616	Methods in Molecular Biology
	MAST634	Marine Molecular Science
	MEDT650	Medical Biochemistry
	MEDT690	Clinical & Molecular Cell Biology
	PLSC619	Soil Microbiology
	PLSC611	Molecular Plant Pathology
<b>Applied Microbiology</b>	ANFS649	Food Biotechnology
	ANFS636	Immunology of Domestic Animals
	CHEG420	Biochemical Engineering
	CHEG621	Metabolic Engineering
	CHEM641	Biochemistry

	CIEG644	Microbiology of Engineered Systems
	MAST616	Methods in Molecular Biology
	PLSC611	Molecular Plant Pathology
	ANFS639	Food Microbiology
<b>Microbial Physiology and Genetics</b>	ANFS649	Food Biotechnology
	ANFS671	Paradigms in Cell Signaling
	CHEG420	Biochemical Engineering
	CHEG621	Metabolic Engineering
	CHEM641	Biochemistry
	CIEG644	Microbiology of Engineered Systems
	MAST616	Methods in Molecular Biology
	MEDT650	Medical Biochemistry
	MEDT690	Clinical & Molecular Cell Biology

## **B. Microbiology Graduate Program Faculty, Committees and Director(s)**

The Microbiology Graduate Program will be overseen by a Director and Associate Director from different colleges. The program's development, assessments, and administration will be overseen by both Directors.

### **B.1. Faculty Membership**

To ensure that students are adequately advised, faculty interested in becoming Microbiology Graduate Program-affiliated faculty and advising students in the program

will be asked to provide a CV and a short statement of their microbiology experience. New members will be added after a favorable vote by the steering committee.

## B.2 Microbiology Steering Committee

The MGP has a Steering Committee made up of faculty representing each of the five involved colleges, with at least one and a maximum of two representatives from each college. Nominations will be solicited when the nominations for Director are solicited, and faculty in each college will elect representative(s) for their college. Voting will take place by email, with votes collected by the staff program coordinator. Faculty on the steering committee will serve for 3-year terms. Committee members and the faculty who elect them will all be MGP-affiliated faculty who can advise students in the Microbiology Graduate Program. The Steering Committee will meet at least once per semester, and will advise the director(s) on faculty membership, student admissions, program assessment, changes to course listings, changes to program policies, and other issues as they arise.

## B.3. Director(s)

The Director and Associate Director of the Microbiology Graduate Program will be responsible for the overall implementation, quality and progress of the degree program, advised by the Steering Committee. For continuity and representation across this interdisciplinary program, the Director and Associate Director should represent different colleges. Nominations for both positions will be solicited six months before the current director's term ends (early in the spring semester), and candidates will be asked to provide short statements specifying their visions for the short- and long-term future of the program. Program faculty will vote by email, with votes collected by the staff program coordinator. The Director and Associate Director will serve for up to two three-year terms, starting in the fall semester.

## C. Satisfactory Progress

### C.1. Faculty Advisor

#### a. M.S. students

Masters' students must have identified a faculty advisor **prior** to acceptance into the program and the faculty advisor must have (a) agreed to mentor this student and (b) funding for the duration of the student's time at UD.

#### b. Ph.D. students

Until a primary research advisor has been identified, students will be advised by one of the Director(s). Faculty willing to advise new students will submit their names to the Program Director by March 15; incoming Ph.D. students will identify three faculty from

this list with whom to do rotations. Each rotation will last 6 weeks during the first semester after matriculation. Students also have the option of doing a rotation during the summer prior to matriculation. At the end of the first semester, students will decide which lab to join, in consultation with the Program Director.

## C.2. Procedure for Committee Member Selection & Committee Responsibilities

The major advisor and student should discuss potential committee members who might provide support for the student's research. It is the responsibility of the graduate student to ask each committee member if they are willing to serve.

Responsibilities of committee members include the following:

- Work with student to develop a program of study and research
- Review research proposal defense and provide recommendations
- Ensure acquisition of technical skills and professional development
- Serve as advisory body during period of candidacy
- Administer written and oral qualifying examinations to Ph.D. candidates
- Establish the contribution of the thesis or dissertation to chosen area of expertise and determine the degree of scholarship attained by the student

Requirements for the composition of advisory committees are:

### a. M.S. Students:

The committee will consist of a minimum of three members; the advisor and at least one other current and active Microbiology program faculty member (full-time or affiliate within UD). The third member may be Microbiology faculty, other UD faculty, or a scientist external to UD.

### b. Ph.D. Students:

The committee will consist of a minimum of four members; the advisor and at least one other current and active Microbiology program faculty member, as well as one UD faculty member outside the Microbiology program. The fourth member of the committee may either be a UD faculty member or a scientist external to the University, which is strongly encouraged but not required.

Procedures for changes of committee members for both M.S. and Ph.D. students:

Changing committee members should follow these steps: (1) the student and advisor discuss the change to be made and the rationale for it; (2) the student and advisor discusses the change with both the outgoing and incoming committee member either together or separately, as needed; (3) an email is sent to the entire committee, including

the incoming and outgoing members, to inform about the changes. Should the student need to change advisors, the following steps should be taken: (1) the student should discuss the change and reasons for it with one of the Graduate Program Directors; (2) the student and the Directors should determine a suitable advisor; (3) the student and Director should discuss, as/if needed, the ensuing change as per the steps above. For all changes, a committee form must be changed accordingly and emailed to the Directors.

### C.3. Academic Load

Full-time students should complete the MS in two years, with 30 credits total, while the Ph.D. program should be completed in four to six years, with 42 credits total.

In any given semester, students enrolled in at least 9 credit hours or in sustaining credit are considered full-time students. Those enrolled for fewer than 9 credit hours are considered part-time students, although students holding assistantships are considered full-time with six credits. Generally, a maximum load is 12 graduate credit hours; however, additional credit hours may be taken with the approval of the student's adviser and the Office of Graduate and Professional Education. A maximum course load in either summer or winter session is 7 credit hours. Permission must be obtained from the Office of Graduate and Professional Education to carry an overload in any session.

### C.4. Transferability

Graduate level courses (up to 9 credits-worth) taken prior to acceptance into the Microbiology Graduate Program at UD will be considered by the Program Committee toward completion of a Ph.D.

### C.5. Master's Degree Requirements

Students in the M.S. program will develop their program of study in conjunction with their faculty advisor and their at least one other member from the Microbiology Graduate Program. The thesis committee must be established by the beginning of the student's second semester of their program, and submitted to the Steering Committee for approval. Specific courses for MS degrees are listed in section B. Students should develop a working draft of a thesis for their committee's approval by the end of their first year in the program. Students must submit a final thesis to their committee, two weeks before their thesis defense date, along with an announcement of their thesis defense seminar, advertised to the Microbiology Graduate Program. The defense seminar will be open to the public, along with all members of the Microbiology program. Students are expected to complete 24 credit hours of course-work and 6 hours of thesis research (total of 30 hours) within two years. The program may be completed over a

longer time frame for part-time students. The maximum time for completion of a MS degree is 5 years from the time of entry.

#### a. MS Timeline

- Beginning 2<sup>nd</sup> semester: Thesis committee established and approved/meet with committee
- End of 2<sup>nd</sup> semester: thesis draft turned into committee/meet with committee
- Beginning of 4<sup>th</sup> semester: thesis defense seminar scheduled in appropriate seminar series
- End of 4<sup>th</sup> semester: final thesis turned into student's committee/seminar & defense

#### C.6. Ph.D. Degree Requirements

Students in the Ph.D. program will develop their program of study in conjunction with their faculty advisor and their at least one other member from the Microbiology Graduate Program. The dissertation committee must be established by the beginning of the student's second semester of their program, and submitted to the Steering Committee for approval. Specific courses for Ph.D. degrees are listed on pages 6-7. Students should develop a proposed plan of study for their committee's approval by the end of their first year in the program. Students are expected to complete 18 credit hours of course-work and 9 hours of research and 9 credit hours of thesis (total of 42) and must maintain a minimum of 3.0 in order to receive the Ph.D. degree in Microbiology. Courses taken towards the 18 credit hours, which are below a B- grade, will not count towards the degree. The student is expected to meet with their committees every six months to ensure progress towards degree.

Between the end of Year 2 and beginning of Year 3, the student should schedule their qualifying exams (written and oral). The faculty advisor will determine the specific nature of the exam, with guidance, as needed from the Program Committee and from the student's Dissertation Committee, however both written and oral must be passed in order to advance to candidacy, and one or both should draw upon key concepts from the core curricula. The Dissertation Committee will be responsible for grading both portions, and will provide a single grade of PASS or FAIL. A grade of FAIL will result in the dismissal of the student from the program, however the student may also receive a "Conditional PASS", which requires the student to complete specific tasks in a timeframe set by the Dissertation Committee, and to their satisfaction. Upon successfully completing the qualifying exam, the advisor will notify the Program Steering Committee.

Students will write a dissertation proposal and submit it to the committee at least 6 weeks before the oral defense date. Committee members will each provide one written question to the student, based on coursework and applied to the thesis topic, within 2 weeks of receiving the proposal. Students then provide written responses to the questions from the committee in a time frame defined by the committee, but before the oral defense date. Students will then present and defend their thesis proposal to the committee. The committee may ask students any questions related to the proposed work, completed coursework, and the committee's questions during this defense. Outcomes may be: Unconditional Pass, Conditional Pass (student will pass, provided they meet criteria such as additional coursework or revised written exam answers), Re-Examination (student did not meet the criteria for passing, but could do so with additional preparation), or Fail.

Upon the recommendation of the Dissertation Committee the student may be admitted to candidacy for the Ph.D. degree. The stipulations for admission to doctoral candidacy are that the student has (1) had a program of study approved, (2) completed one academic year of full-time graduate study in residence at the University, (3) passed the program's qualifying examination, (4) demonstrated the ability to do research, and (5) had a research project accepted by the Dissertation Committee. The student must submit a research pre-proposal prior to initiating dissertation research. A pre-proposal should be prepared within the first year and should be shared with the Dissertation Committee (preferably at the time of formation of the committee). A formal, more detailed, proposal should be developed and submitted to the Dissertation Committee for approval. After approval by the Dissertation Committee, the Program Committee will be notified and a copy of the proposal will be placed in the program records.

The final examination of the PhD degree will involve approval of the written dissertation and an oral defense of the candidate's dissertation. The written dissertation will be submitted to the Dissertation Committee and the Microbiology Graduate Program office at least three weeks in advance of the oral defense date. The oral defense date will be publicly announced at least two weeks prior to the scheduled date and will be open to the public and all members of the Microbiology Graduate Program. The Dissertation Committee will approve the candidate's dissertation. The student and graduate advisor will be responsible for making all corrections to the dissertation document and for meeting all Graduate School deadlines for submission. **Ph.D. candidates must have at least one year between their qualifying exam and their dissertation defense.** Formal grading of committee examinations is at the discretion of the student's graduate committee.

The maximum time for the completion of the PhD program is 7 years from the time of entry.

a. Ph.D. Timeline

- Year 1: Complete rotations (first ½ of Year 1); dissertation committee established and approved/meet with committee
  - Year 2-3: meet with committee/schedule and take qualifying exam
  - Year 4: meet with committee to discuss progress
  - Year 5: prepare for dissertation defense/schedule defense as per degree time-frame above
- MS

C.7. Grade Requirements

Only graduate courses completed with a grade of B- or higher will count towards the requirements of the MS and Ph.D. program in Microbiology. In special cases, 300 level, upper-undergraduate level courses may be required to supplement the student's knowledge-base, but will not be counted towards overall credits. Students must obtain at least a 3.0 cumulative grade point average in the courses in the curriculum to receive the degree.

C.8. Procedures for thesis/dissertation approval

Admission to candidacy for the Ph.D. degree, and acceptance of the M.S. thesis or Ph.D. dissertation in partial fulfillment of the degree requirements, will be recommended if no more than a single dissenting vote is cast by the graduate committee.

C.9. Guidelines for research proposals Involving human or animal subjects

Success depends upon following all UD rules and regulations. Students working with human or animal subjects in the Microbiology Graduate Program must attend human or animal subjects training and request approval from the human or animal subject committee at the University. Proposals that include interviews, case studies, or other interrogative methodologies must have all questions approved by the University Human Subjects Review Board.

C.10. Consequences of unsatisfactory academic progress

The Microbiology Program Committee will meet once each semester to evaluate each student's progress. If a student is failing to make satisfactory progress towards a degree, the committee will recommend suitable action to the Microbiology Graduate Program Director(s). Possible actions include (but are not limited to): (i) requirement for additional courses, (ii) suspension of financial support, and (iii) recommendation for dismissal.

#### C.11. Standards of student conduct

All graduate students are subject to University of Delaware regulations regarding academic honesty. Violations of the UD regulations regarding academic honesty or other forms of gross misconduct may result in immediate dismissal from the Program.

#### C.12. Dismissal

The procedures for dismissal as detailed in the University Catalog will be followed. Briefly, the Graduate Committee will report its recommendation and reason for dismissal to the Microbiology Graduate Program Director(s). The Director(s) will make a recommendation to the Office of Graduate Studies, who will decide whether to dismiss the student. The student may appeal this decision to the Office of Graduate Studies, following the procedure given in the University Catalog.

#### C.13. Graduate student grievance procedures

Students who feel that they have been graded inappropriately or receive what they perceive as an unfair evaluation by a faculty member may file grievances in accordance with University of Delaware policies. Students are encouraged to contact the Microbiology Graduate Program Director(s) prior to filing a formal grievance in an effort to resolve the situation informally.

## IV. Financial Aid

### A. Financial Awards

#### A.1. Unidel award funds: 2019 and 2020

In 2019 and 2020, four applicants will be accepted into the Microbiology Graduate Program per each of those years, and will be funded for a 12 month calendar year with regard to stipend, tuition and fringe benefits. After each cohort's first year, the student's selected advisor will take over these budget items for the duration of the students' tenure. Unidel funds will be awarded to Ph.D. students.

#### A.2. Admission costs post 2020

Admission to the Microbiology Graduate Program does not automatically entitle an applicant to financial aid. Students may seek financial aid opportunities, such as fellowships or scholarships from sources within the University and from private and federal agencies. Interested students should check the Office of Graduate Studies website for the most current opportunities (<https://grad.udel.edu/>).

Financial aid is awarded on a competitive basis from the pool of admitted applicants. The University of Delaware's policies apply to all forms of financial aid. Please refer to the University Policies for Graduate Student Assistantships and Fellowships. Students in the Microbiology program may apply for Graduate Assistantships:

Research Assistantships (RAs) are generally funded by research grants and contracts provided by external funding agencies. Students may be supported as an RA through their Faculty Advisor's research funds after their first year. A research assistantship provides appropriate amount of tuition per College guidelines, and a stipend. The RA's advisor is responsible for defining the student's responsibilities and for evaluating the student's performance. The amount of service or research may vary from week to week but the average is usually expected to be 20 hours per week.

Teaching Assistantships (TAs) are offered for graduate students to perform teaching and other instructional activities by individual departments. The amount of service may vary from week to week but the average is usually expected to be 20 hours per week. A teaching assistantship provides full tuition and a stipend. Award of TA will be decided by the primary advisor and their department.