I. GUIDELINES FOR GRADUATE EDUCATION

Two sets of guidelines are provided for graduate study in the Department of Biochemistry:

1. The Graduate School has general guidelines, which are found in the document *Expectations for Graduate Education*.
2. The Department of Biochemistry guidelines, which are outlined in this Handbook.

II. OVERVIEW OF DOCTORAL DEGREE REQUIREMENTS

The doctoral program in the Department of Biochemistry at Virginia Tech prepares students for careers as independent researchers in biochemistry, molecular and cellular biology, molecular microbiology, biotechnology, and related areas. Training involves a combination of advanced coursework, participation in seminars, and laboratory research conducted under the guidance of a faculty committee selected by agreement of the student, the faculty advisor, and the departmental Graduate Committee.

**Graduate School**
- Complete 90 credits of graduate study.
- The 90 total credits must include 30 graded credits (i.e. from coursework).
- Pass the Preliminary Examination and dissertation defense.
- Complete the ethics and research integrity training.

**Biochemistry Department**
- Successfully complete two core courses and five specialized courses during their first two years.
- Maintain a cumulative GPA of 3.0 or above in all coursework.
- Enroll in three laboratory rotations during the first semester.
- Deliver two departmental seminars for A-F grade while registered in the doctoral program.
- Serve as Teaching Assistants for Biochemistry courses for two semesters during the first two years.
- Pass the Qualifying Examination at the end of the Spring semester of the first year.

III. OVERVIEW OF MASTER OF SCIENCE DEGREE REQUIREMENTS

The Master of Science in Life Sciences (MSLFS) merges the efforts of the departments of Biochemistry, Entomology, Food Science and Technology, and Plant Pathology, Plant Physiology, and Weed Science. Students in basic and applied disciplines in the College of Agriculture and Life Sciences share common experiences that prepare them for careers in which interdisciplinary interactions become increasingly valued. At the same time, discipline-specific education and research experience, which characterizes the MSLFS program in each department, prepares students for unique positions and career development.

For graduation, students must complete a minimum of 20 graded credit hours (thesis option) or 24 graded credit hours (non-thesis) among 30 total credit hours.

**Graduate School**
- Complete 30 credits of graduate study.
The 30 total credits must include 20 graded credits (thesis) or 24 graded credits (non-thesis).

Complete the ethics and research integrity training.

Biochemistry Department

- Successfully complete two core courses and additional specialized courses.
- Maintain a cumulative GPA of 3.0 or above in all coursework.
- Successfully complete 6-10 credits of Research and Thesis (thesis option only) or other specialty coursework, research projects, or approved internships (non-thesis option).
- Present a departmental seminar and defend a thesis (thesis option only)
- Serve as Teaching Assistants for Biochemistry courses for one semester

IV. COURSEWORK

Core Courses for All Graduate Students

There are two core courses that are taken by all Biochemistry graduate students in the first year, BCHM 5224 “Protein Structure and Function,” taken in the Fall semester, and BCHM 5784 “Advanced Applications in Molecular Life Sciences,” taken in the Spring semester. All students will enroll in ALS 5324 “Research Ethics in Agriculture and Life Sciences” in the Fall semester to satisfy the Graduate School’s requirement for training in ethics and research integrity (see Section VIII).

Specialized Courses

Doctoral students will complete five additional courses during the first two years and MSLFS students complete courses throughout their enrollment. Students should confer with their Major Professor and Advisory Committee to select the most appropriate courses. Students are strongly encouraged to complete all course requirements by the end of year 2. See Section XIV for some graduate-level courses that may be of interest. See also a complete list of graduate courses by department.

Seminar Courses

BCHM 5004  Seminar in Biochemistry

Students will enroll in the 1-credit departmental seminar class every semester while they are registered in the graduate program.

Professional Development Courses

There are a number of professional development courses that may be of interest. Students should confer with their Major Professor and Advisory Committee to decide whether one of these might be beneficial. The indicated GRAD 5XXX courses are recommended for more advanced students and are generally not taken in the first year.

BIOL  5154  Exercises in Grantsmanship
GRAD 5104  Preparing the Future Professoriate
GRAD 5114  Contemporary Pedagogy

See all professional development courses offered by the Graduate School: Transformative Graduate Education

Research and Dissertation (Doctoral students)

BCHM 7994  Research and Dissertation

The number of credits of BCHM 7994 is such that a total of 12 credits is taken per semester as required for full-time status. These credits contribute to the 90-credit graduate study requirement.
Research and Thesis (MSLFS students)
BCHM 5994 Research and Thesis
MSLFS students who choose the thesis option will enroll in BCHM 5994 for a total of 6-10 credits to meet the 30-credit graduate study requirement.

Comparison of Doctoral and MSLFS Program Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Doctoral</th>
<th>MSLFS (non-thesis)</th>
<th>MSLFS (thesis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Credits</td>
<td>90</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Graded Credits</td>
<td>30</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>Required Courses</td>
<td>BCHM 5224 (3 cr)</td>
<td>BCHM 524 (3 cr)</td>
<td>BCHM 5224 (3 cr)</td>
</tr>
<tr>
<td></td>
<td>BCHM 5784 (3 cr)</td>
<td>BCHM 5784 (3 cr)</td>
<td>BCHM 5784 (3 cr)</td>
</tr>
<tr>
<td></td>
<td>ALS 5324 (1 cr)</td>
<td>ALS 5324 (1 cr)</td>
<td>STAT 5605/STAT 5615/ALS 5984 (3 cr)</td>
</tr>
<tr>
<td>Elective Credits</td>
<td>13+</td>
<td>20</td>
<td>10-14</td>
</tr>
<tr>
<td>Laboratory Rotations</td>
<td>Yes</td>
<td>No</td>
<td>Optional</td>
</tr>
<tr>
<td></td>
<td>BCHM 5014 (8 cr)</td>
<td>No</td>
<td>BCHM 5014 (8 cr)</td>
</tr>
<tr>
<td>Required Research Credits (BCHM 5994 or BCHM 7994)</td>
<td>(varies)*</td>
<td>0</td>
<td>6-10</td>
</tr>
<tr>
<td>Seminar Requirement</td>
<td>BCHM 5004 every semester, 2 graded presentations</td>
<td>BCHM 5004 (2-3 cr)</td>
<td></td>
</tr>
<tr>
<td>Internship</td>
<td>No</td>
<td>Optional</td>
<td>No</td>
</tr>
<tr>
<td>Experiential Learning</td>
<td>No</td>
<td>BCHM 5974 (3 cr maximum)</td>
<td>No</td>
</tr>
<tr>
<td>Advisory Committee</td>
<td>Spring of Year 1, 4 members</td>
<td>Within first 2 weeks**</td>
<td>3 members</td>
</tr>
<tr>
<td>Qualifying Examination</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Preliminary Examination</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Defend Dissertation or Thesis</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* BCHM 7994 comprises the balance of credits necessary to maintain full-time status each semester. See typical schedule (next page) for guidance.
** MSLFS students opting to conduct research rotations in the Fall semester of Year 1 will form their Advisory Committee within 2 weeks of selecting a Major Professor. Students who do not rotate will form an Advisory Committee within the first two weeks of Fall semester of Year 1.

Typical Schedule for a Biochemistry Doctoral Student

<table>
<thead>
<tr>
<th>Year 1</th>
<th><strong>Fall</strong></th>
<th>Credits</th>
<th><strong>Spring</strong></th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCHM 5004 Biochemistry Seminar</td>
<td>1</td>
<td>BCHM 5004 Biochemistry Seminar</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BCHM 5224 Protein Struct &amp; Function</td>
<td>3</td>
<td>BCHM 5784 Adv Applic in Mol Life</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

3
<table>
<thead>
<tr>
<th>Specialty Course</th>
<th>Credits</th>
<th>Specialty Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXXX XXXX</td>
<td>3</td>
<td>XXXX XXXX</td>
<td>1-3</td>
</tr>
<tr>
<td>BCHM 5014</td>
<td>4</td>
<td>XXXX XXXX</td>
<td>1-3</td>
</tr>
<tr>
<td>ALS 5324</td>
<td>1</td>
<td>BCHM 5014</td>
<td>4</td>
</tr>
<tr>
<td>Rotations</td>
<td></td>
<td>(research)*</td>
<td></td>
</tr>
<tr>
<td>BCHM 7994</td>
<td>8</td>
<td>Biochemistry Seminar</td>
<td>8</td>
</tr>
<tr>
<td>Research Ethics</td>
<td>1</td>
<td>BCHM 5004</td>
<td>1</td>
</tr>
<tr>
<td>in Ag &amp; Life Sci</td>
<td>3</td>
<td>Biochemistry Seminar</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

**Year 2**

<table>
<thead>
<tr>
<th>Specialty Course</th>
<th>Credits</th>
<th>Specialty Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCHM 5004</td>
<td>1</td>
<td>BCHM 5004</td>
<td>1</td>
</tr>
<tr>
<td>XXXX XXXX</td>
<td>3</td>
<td>XXXX XXXX</td>
<td>3</td>
</tr>
<tr>
<td>BCHM 7994</td>
<td>8</td>
<td>BCHM 7994</td>
<td>8</td>
</tr>
<tr>
<td>Research &amp;</td>
<td></td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Dissertation</td>
<td></td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

**Years 3+**

<table>
<thead>
<tr>
<th>Specialty Course</th>
<th>Credits</th>
<th>Specialty Course</th>
<th>Credits</th>
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</thead>
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<tr>
<td>BCHM 5004</td>
<td>1</td>
<td>BCHM 5004</td>
<td>1</td>
</tr>
<tr>
<td>BCHM 7994</td>
<td>11</td>
<td>BCHM 7994</td>
<td>11</td>
</tr>
<tr>
<td>Research &amp;</td>
<td></td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Dissertation</td>
<td></td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

*Evaluated by the Advisory Committee during the first meeting. The evaluation is based on research performance, presentation, and report.

**Notes on Course Requirements**

- Graded course work on the Plan of Study must be taken for an A-F grade unless the course is only offered P/F. Courses offered P/F can be used to meet the graded credit minimum if only offered P/F.
- At least 27 graded credits (doctoral) or 12 graded credits (MSLFS) must be at the 5000 level or higher.
- The 5000-level coursework may include a maximum 18 credits total in 5974, 5984, and 6984 courses and 4 credits of seminar.
- The Plan of Study may include a maximum of six credits of graded 4000-level undergraduate coursework. These six credits of 4000-level coursework may include Special Study (4984) but may not include Undergraduate Independent Study (4974) or Undergraduate Research (4994) courses.
- MSLFS students may count three of the six credits for BCHM 4124 towards Experiential Learning, but the full six credits count towards the maximum of 4000-level coursework.
- Students who are not serving as teaching assistants during the first three semesters, but during which they are supported by the department, are required to take an additional 3-credit graduate-level course. This course will count towards the five required specialized courses.

**V. RESEARCH ROTATIONS**

Rotations are an opportunity for students to learn about the diversity of research in the department and help inform the selection of a mentor. Rotations are optional for MSLFS students but are required for doctoral students.
General Information

- First-year students conduct three laboratory rotations, each approximately 4 weeks in duration.
- See the Table below for due dates for rotation selection and for begin and end dates for each rotation. Students will communicate their rotation and Major Professor choices with the faculty Rotation Coordinator.
- Students will give brief presentations (15 minutes for the presentation and 5 minutes for discussion) at the end of two of their rotations as part of the weekly seminar series. Students will be notified at least three weeks in advance of their scheduled date to present.
- For the rotation for which they do not give a presentation, students will write a short journal “note” or research report. Students should discuss an appropriate format with their advisors. Example formats include FEBS Letters, Rapid Reports format of Biochemistry, and BMC Research Notes. Reports should be submitted to rotation advisors by the last day of the rotation.
- Register for BCHM 5014 as PASS/FAIL. The decision to give a “passing” grade will be made jointly by the rotation mentor and the Graduate Committee and is based primarily on day-to-day performance in the laboratory. Rotation mentors provide detailed feedback in a formal evaluation letter that is included in the student’s file.

Selection of Major Professor

After discussions with faculty of interest, students will submit a ranked list of preferences for their major professor to the Graduate Committee rotation coordinator by the date indicated in the Table below. Students may choose to work with faculty other than those with whom rotations were performed. Every effort will be made to place students according to their preferences given the resources available.

Fall 2018 Rotations: Important Dates

<table>
<thead>
<tr>
<th>Rotation</th>
<th>List of labs due (by 8:30 AM)</th>
<th>Lab assignment (by noon)</th>
<th>Begins</th>
<th>Ends</th>
<th>Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08/20/2018</td>
<td>08/20/2018</td>
<td>08/21/2018</td>
<td>09/21/2018</td>
<td>09/24/2018</td>
</tr>
<tr>
<td>2</td>
<td>09/17/2018</td>
<td>09/19/2018</td>
<td>09/25/2018</td>
<td>10/19/2018</td>
<td>10/22/2018</td>
</tr>
</tbody>
</table>

Ranked list of three labs/Major Professors 11/26/2018 (by 8:30 AM)

Major Professor lab assignment 11/27/2018 (by noon)

PhD research project begins 11/29/2018

VI. QUALIFYING EXAMINATION

To complete the Qualifying Examination, students will write and orally defend an original research proposal that is unrelated to the student’s doctoral research. This proposal will follow the same guidelines outlined below for the Preliminary Exam (see Section IX), except that the proposal will be limited to 5 pages. Students must successfully complete this requirement by the end of Spring semester of the first year. The written portion of the proposal will be completed by all graduate students as part of the course requirements for BCHM 5784. The instructor for this course will arrange for the oral defense of the proposal for doctoral students. MSLFS students may elect to take the Qualifying Examination by
notifying the instructor of BCHM 5784. Doing so allows MSLFS students to enter the doctoral program upon completion of their M.S. degree if they choose.

Failure of the Qualifying Exam is not by itself a cause for expulsion from the program. Rather, the Graduate Committee will consider the totality of the student’s academic record and will reach a decision regarding continuation of the student in the program.

VII. TEACHING
All doctoral students serve as teaching assistants for two semesters, usually within the first three semesters of enrollment. MSLFS students serve as teaching assistants for one semester. Students will be notified of their assignment no later than one week prior to the start of the upcoming semester. For each course, TAs will be responsible for at least one meaningful teaching experience beyond preparing materials and grading student work. Examples include leading a discussion, giving a guest lecture, or leading a help session for working on problem sets and/or preparing for exams.

The goals for the TA assignment are primarily for students to:

- Develop teaching and communication skills, and
- Support the implementation of undergraduate courses, especially courses that enroll many students (large lecture courses) or that require significant time or effort to prepare materials (lab courses).

VIII. ETHICS AND RESEARCH INTEGRITY (E&RI) TRAINING
Commission on Graduate Studies and Policies Resolution 2012-13B mandates that “the Program of Study for all graduate students show a record of the student’s participation in the particular ethics and integrity activities delineated by the student’s program, department, or college, as part of the student’s graduation requirements.” This requirement came into effect for students matriculating in Fall 2014.

Required components
- ALS 5324 Research Ethics in Agriculture and Life Sciences
- BCHM 5784 Advanced Applications in Molecular Life Sciences
- GRAD 5004 GTA Training Workshop

Additional research-specific ethics training (e.g. in treatment of animals or human subjects research) may be required by the student’s Advisory Committee.

Implementation
The Department of Biochemistry will ensure the implementation of the ethics and integrity training component in the education of our graduate students in the following ways.

- The E&RI Training Plan will be provided to incoming graduate students during Orientation Week, which takes place the week prior to the start of classes. The Graduate Program Director will discuss the requirements with the students.
- At the first meeting with their Advisory Committee, graduate students will describe their progress in satisfying the E&RI training requirements and will outline a plan for completing any outstanding
requirements. The Committee will also determine whether any additional training is required on the basis of the student’s research plans.

- The Advisory Committee will confirm that students have completed all required elements of the E&RI Training Plan prior to defense of the thesis.
- Completion of the E&RI training requirement will be documented on the student’s Plan of Study.

IX. THESIS AND DISSERTATION RESEARCH

Advisory Committee
In consultation with their Major Professor, students should select members of their Advisory Committee by considering whose expertise would be most relevant to the student’s research. The Advisory Committee for doctoral students requires a minimum four faculty, of whom three must be affiliated with the Biochemistry Department (either departmental or adjunct faculty). MSLFS committees should comprise three faculty. The Major Professor serves as the Chair of the Advisory Committee. For doctoral students, the Advisory Committee should meet before the end of the Spring semester of the first year. For MSLFS students, this meeting should occur before the end of the Fall semester of the first year. The Graduate Committee will serve in an advisory capacity for students prior to their selection of a Major Professor.

An annual meeting with the Advisory Committee is mandatory. More frequent meetings may be scheduled as desired by the student and/or Advisory Committee. Before each meeting, a written summary of the student’s research progress must be submitted to the Advisory Committee no later than one week ahead of the meeting time. An exception to this requirement is made for the first meeting with the Advisory Committee.

Plan of Study
The Graduate School requires all graduate students to submit a valid Plan of Study. Each student should begin to prepare his/her Plan of Study at the end of the first academic year. Students should use the worksheet available from the department office and seek the assistance of their Major Professor. The Plan of Study must then be presented to, and approved by, the student’s Advisory Committee, including a projected date for taking the Preliminary Examination (doctoral students only). The Plan of Study and the projected date for the Preliminary Examination are then submitted to the Department Head and the Graduate School for review and approval. Department staff submit the Plan of Study to the Graduate School electronically.

Preliminary Examination
To advance to Ph.D. candidacy, students must pass a Preliminary Exam consisting of an oral defense of a written original research proposal. The purpose of this Exam is to determine whether a student has sufficient depth and breadth of understanding to propose, execute and defend their dissertation research project.

Scheduling the Preliminary Exam
The Preliminary Exam must be scheduled with the Graduate School using the online form. The Exam must take place by the end of the second academic year (i.e. by the first week of May).
Preliminary Exam Committee
In the Biochemistry Department, the Major Professor is not part of the Preliminary Exam Committee. Because the Graduate School requires that the doctoral Preliminary Exam Committee have four members, the Chair of the Preliminary Exam Committee is selected from faculty outside of the Advisory Committee. Before the Preliminary Exam, the student should make a request to a faculty member to serve as the Chair of the Exam Committee. The request should then be sent to the Graduate Program Director.

Written research proposal
- Students prepare a 10-page original research proposal based on their dissertation project.
- The proposal can be formatted according to National Institutes of Health or National Science Foundation guidelines (except for length) and must include descriptions of the significance, background, impact, and research plan of the project. Research plans should include the underlying rationale, significance, experimental design, anticipated results, alternative hypotheses or explanations, and potential problems as well as how problems will be addressed (i.e. backup plans). While proposals may include preliminary results, this section should be kept to a minimum (around one page) with the bulk of the proposal focused on describing plans for completing the dissertation research.
- The writing of the proposal must be original. Students should avail themselves of all available resources but cannot copy verbiage from any grant proposals or manuscripts written by others. If there is a connection between the student's research proposal and work that the advisor has proposed, the student's research aims and proposed activities should build upon, and move beyond, those of the advisor. The role of the major advisor is to discuss with the student his/her research goals and objectives, principles of experimental design and techniques, and elements of good scientific writing. The advisor should not author verbiage for the student.
- Three weeks prior to oral examination, proposals must be submitted to the committee for determination of whether the proposal is satisfactory for oral defense. The Exam Committee Chair will consult with the Major Professor and decide whether the student can proceed with the oral exam. Minor issues can be corrected and the proposal redistributed prior to oral exam. Substantial issues that require considerable rewriting may require rescheduling of the oral exam.
- The final document must be distributed to the Exam Committee one week prior to the oral exam.
- Except in extraordinary circumstances, a student who misses a distribution deadline will need to reschedule the oral exam.
- Except in extraordinary circumstances, a student who fails to make timely progress in completing both aspects of the Preliminary Exam will have this issue noted in an annual or semi-annual evaluation and will be at risk of dismissal from the program.

Oral Exam
- Students should prepare a brief (~10 minute) overview of their proposal.
- Committee members will question the student with the research proposal as a starting point. Questions will focus on assessing the student’s ability to design experiments, interpret experimental results, and recognize alternate approaches should the main strategy fail.
- Discussion will not be limited to the research proposal. Members of the Exam Committee may pursue whatever other areas they feel are necessary to evaluate the abilities and knowledge of the student, including topics addressed in the coursework the student has completed.
- Based on a student’s performance during the exam, the committee will recommend: (a) advancement to candidacy, (b) conditional advancement contingent upon completion of recommended coursework or individual study, or (c) failure. In the event of failure, a second Preliminary Exam must be scheduled during the semester immediately following the first attempt.
- Students are allowed a maximum of two opportunities to pass the Preliminary Exam.
- The Exam Committee Chair will provide a letter to the student describing the outcome of the exam, summarizing the strengths and weaknesses of the student’s performance, and articulating the committee’s recommendations regarding the student’s future work. The letter is sent to the student with copies sent to the Major Professor and the Biochemistry Department for inclusion in the student’s file.

### Timeline for Completion of Qualifying and Preliminary Exams

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Qualifying Exam</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Preliminary Exam</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Retake Prelim Exam if necessary</td>
<td></td>
</tr>
</tbody>
</table>

### Annual Evaluation

As required by the Graduate School, the Major Professor will submit a written annual evaluation of the student’s progress. The evaluation will be distributed to the Graduate Program Director, the Graduate School, members of the Advisory Committee and the student.

### Publications

Students are expected to publish their research in peer-reviewed, professional journals. Therefore, students should have published their research, or should provide the Major Professor with manuscript(s) in the appropriate format for publication, prior to the time of graduation.

### Research Presentations

After passing the Preliminary Exam and before the Thesis Defense, students are required to give two oral presentations on their research. This may be fulfilled by giving two presentations in BCHM 5004 “Seminar in Biochemistry” (only one presentation per semester). Oral presentations at scientific meetings also count towards this requirement.

### Thesis Defense/Final Exam

Degree candidates are required to present a departmental research seminar prior to the Final Exam (i.e. thesis defense). Candidates for the Ph.D. degree must take an oral Final Exam, which is primarily a defense of their dissertation. The Final Exam is scheduled by submitting electronically a completed form “Request to Admit Candidate to Final Exam” to the Graduate School two weeks in advance of the exam date. The Final Exam is an opportunity for candidates to discuss their research project. The student passes the Final Exam if all or all but one member of the Advisory Committee votes for approval. However, the degree is conferred only after the Electronic Thesis and Dissertation (ETD) Approval Form
has been signed by Advisory Committee members and submitted within two weeks to the Graduate School, and the Graduate School has approved the ETD. See also Graduate School guidelines for final semester enrollment, degree completion and commencement. Students are encouraged to submit the “Application for Degree” on HokieSPA the semester before they plan to graduate, at which time a "to do" list will be generated to assist in timely completion of all requirements.

**Doctoral Student Timeline**
This table depicts the prescribed timeline for doctoral students who enter with a Bachelor’s degree to complete the activities noted above for completion of a doctoral degree.

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Committee Established</th>
<th>Plan of Study Filed</th>
<th>Prelim Exam Taken</th>
<th>Dissertation Defended</th>
<th>Dissertation Submitted</th>
<th>Graduated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>End of spring semester of 1st year</td>
<td>End of spring semester of 1st year</td>
<td>End of spring semester of 2nd year</td>
<td>Within six years</td>
<td>Within six years</td>
<td>Within six years</td>
</tr>
</tbody>
</table>

**X. CAREER DEVELOPMENT**
Most graduate and post-doctoral trainees do not end up in academic tenure-track positions. It is important that graduate students think about and plan for their post-graduation careers. Fortunately, there is a growing number of resources and opportunities for help with this.

**Broadening Experiences in Scientific Training (BEST) Project**
Virginia Tech has recently been awarded a BEST grant from the National Institutes of Health to support professional development activities for doctoral students and postdoctoral trainees in the biomedical sciences. You may enroll in one or more of the BEST program activities that are designed to Broaden the Experiences of Scientific Trainees in order to:

- provide exposure to multiple diverse career paths in the biomedical sciences
- provide early career guidance and skill development
- better prepare trainees to pursue a variety of career paths

**Transformative Graduate Education (Graduate School)**
Transformative Graduate Education is a university-wide initiative developed by Vice President and Dean for Graduate Education Karen DePauw and facilitated by the Graduate School. The implementation of unique programs and opportunities pushes the boundaries of traditional disciplinary academic education and provides the philosophical underpinnings for a truly innovative graduate education experience. The initiative aims to significantly change how graduate students are prepared to become the next generation of scientists, educators, scholars, engineers, artists, and career professionals in an ever-evolving global context.

**Graduate School Courses**
Toward the goal of transforming graduate education at Virginia Tech, the Graduate School has created a series of graduate courses and experiences designed to better prepare and equip our graduate students with knowledge and skills for meaningful and relevant contributions as citizens in the 21st century.
Individual Development Plan (IDP)
The National Institutes of Health recommends that all NIH-funded trainees prepare an Individual Development Plan to explore and set career goals. There is a free IDP web interface run by the journal Science.

Career Services, Division of Student Affairs
Career Services can assist with all aspects of career planning. See services directed to graduate students.

XI. FACILITIES

Keys
Keys are available for the main door, reading room, and for specific laboratories. Keys for Engel Hall are distributed by Zerita Montgomery (Engel main office, room 111) upon payment of a deposit. Keys for Fralin are distributed by Paul Bibb (Fralin main office). Students needing access to other buildings should consult their Major Professor.

Reading Room
A Reading Room (Engel 217B) is available for use by graduate students and is accessible with an Engel main door key. The Reading Room contains a refrigerator and microwave, a seating area, and a white board, all for general use.

Equipment
Students may use any departmental instruments after checking with the appropriate faculty to ensure that the student is knowledgeable in the proper operating techniques and will not interfere with other work in progress. Students should be sure that borrowed items are always signed out, log books are properly maintained, and the instrument and/or lab area are cleaned after use. Students should notify the faculty in charge immediately if equipment malfunctions or breaks during use. Ultimately, Major Professors are responsible for the care of equipment used by their students.
## XII. RESOURCES AND CONTACT INFORMATION

<table>
<thead>
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<th>Topic</th>
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<tr>
<td><strong>Departmental Assistance</strong></td>
<td>Graduate Committee members:</td>
</tr>
<tr>
<td></td>
<td>Dr. Pablo Sobrado, Graduate Program Director</td>
</tr>
<tr>
<td></td>
<td>Dr. Biswarup Mukhopadhyay, Rotation Coordinator</td>
</tr>
<tr>
<td></td>
<td>Dr. Kylie Allen</td>
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<tr>
<td></td>
<td>Dr. Justin Lemkul</td>
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<td></td>
<td>Dr. Dan Slade</td>
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<td></td>
<td>Dr. Jake Tu</td>
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<tr>
<td></td>
<td>Dr. Clément Vinauger</td>
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<tr>
<td></td>
<td>Graduate Coordinator: Sheila Early</td>
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<td><strong>Writing Resources</strong></td>
<td>Virginia Tech Writing Center</td>
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<td><strong>Teaching Resources</strong></td>
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<td>Graduate Education Development Institute</td>
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<td><strong>Graduate School</strong></td>
<td>Support Resources</td>
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<td>Transformative Graduate Education</td>
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<td>“Graduation 101 Series”- a set of YouTube videos:</td>
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<td></td>
<td>• Graduation Guidelines</td>
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<td>• Preparing for Graduation</td>
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<td>• Start of Semester Defense Exception</td>
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<td><strong>Quality of Life Resources</strong></td>
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<td>Graduate Life Center</td>
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<td>Schiffert Health Center</td>
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XIII. INSTITUTIONAL POLICIES

**Equal Opportunity/Affirmative Action Statement**
Virginia Tech does not discriminate against employees, students, or applicants on the basis of age, color, disability, gender, national origin, political affiliation, race, religion, sexual orientation, genetic information, veteran status, or any other basis protected by law. Discrimination or harassment on any of these bases is prohibited by Policy 1025, "Anti-Discrimination and Harassment Prevention Policy."

**Disability Accommodations**
Accommodations are available for students with disabilities. Please notify the Major Professor and/or course Instructor of any accommodations needed. Accommodations are approved through the Services for Students with Disabilities Office.

**Graduate Honor System**
Compliance with the standards of academic conduct expressed in the Graduate Honor Code is expected of all students.

**Principles of Community**
Virginia Tech is a public land-grant university, committed to teaching and learning, research, and outreach to the Commonwealth of Virginia, the nation, and the global community. Learning from the experiences that shape Virginia Tech as an institution, we acknowledge those aspects of our legacy that reflected bias and exclusion. Therefore, we adopt and practice the following principles as fundamental to our on-going efforts to increase access and inclusion and to create a community that nurtures learning and growth for all of its members:

- **We affirm** the inherent dignity and value of every person and strive to maintain a climate for work and learning based on mutual respect and understanding.
- **We affirm** the right of each person to express thoughts and opinions freely. We encourage open expression within a climate of civility, sensitivity, and mutual respect.
- **We affirm** the value of human diversity because it enriches our lives and the University. We acknowledge and respect our differences while affirming our common humanity.
- **We reject** all forms of prejudice and discrimination, including those based on age, color, disability, gender, national origin, political affiliation, race, religion, sexual orientation, and veteran status. We take individual and collective responsibility for helping to eliminate bias and discrimination and for increasing our own understanding of these issues through education, training, and interaction with others.
- **We pledge** our collective commitment to these principles in the spirit of the Virginia Tech motto of *Ut Prosim* (That I May Serve).
XIV. APPENDIX: SUGGESTED ELECTIVE COURSES

Listed below are recommended graduate-level (5000 and above) courses and allowable 4000-level courses. Note that availability of these courses varies from year to year and students must formulate their Plan of Study accordingly.

General

- BIOL 6704 Eukaryotic Pathogen Host Interaction
- BCHM 5024 Computational Biochemistry for Bioinformatics
- BCHM 5984 Integrated Prokaryotic/Eukaryotic Gene Regulation
- BIOL 5184 Prokaryotic Recombinant Proteins
- BIOL 5214 Biomacromolecular Structure
- BIOL 5424 Computational Cell Biology
- BIOL 5624 Advanced Microbial Genetics
- BIOL 5674 Advanced Pathogenic Bacteriology
- BIOL 5844 Advanced Proteomics and Biological Mass Spectrometry
- BMVS 6724 Molecular Mechanisms of Pathogenic Bacteria
- PPWS 5524 Advanced Plant Physiology and Metabolism I

Computational Biology/Bioinformatics

- GBCB 5045 Computation for the Life Sciences I and II (basic computer science courses)
- BCHM 5024 Computational Biochemistry for Bioinformatics
- BIOL 4075 Bioinformatics Methods
- CS 6824 Advanced Topics in Computational Biology and Bioinformatics (requires CS Background or prerequisites)

Oomics and Systems Biology

- GBCB 5415 Continuous Models in Biological Applications (requires basic foundation in multivariable calculus and ordinary differential equations)
- CS 5424 Computational Cell Biology
- CS 5854 Computational Systems Biology (requires computer science background)
- GBCB 5874 Problem Solving in Genetics, Bioinformatics and Computational Biology
- BMES 5054 Quantitative Cell Physiology (requires computer science background)
- BIOL 4844 Proteomics and Biological Mass Spectrometry
- ENT 5324 Genomics of Disease Vectors
- GBCB 5844 Plant Genomics

Bioengineering

- BSE 4544 Protein Separation Engineering
- BSE 5544 Advanced Protein Separation Engineering
- BSE 4604 Food Process Engineering
- BSE 5604 Advanced Food Process Engineering
- BSE 5644 Bio-Based Industrial Polymers
- BSE 5114 Physical Properties of Biomaterials
- BSE 5504G Bioprocess Engineering
- BSE 5624 Enzyme Engineering
- BSE 5614 Advances in Recombinant Protein Production
- BMVS 5224 Biomedical Engineering and Human Disease (also listed as BMES 5024)
Infectious and Vector-Borne Disease

BIOL 4674  Pathogenic Bacteriology
BIOL 4664  Virology
ENT 5324  Genomics of Disease Vectors
ENT 5624  Molecular Virology
BMVS 5624  Molecular Virology
BMVS 5224  Biomedical Engineering and Human Disease (also BMES 5024)
BMVS 5005  Emerging Infectious Diseases I and II - fully online (also VM 9085/9086)

PHS 5984  SS: Principles of Infectious Diseases
PHS 5304  Zoonoses and Infectious Diseases Common to Humans and Animals
PHS 5314  Infectious Disease Epidemiology
PHS 5334  SS: Modeling Infectious Diseases
BIOL 4704  Immunology
FST 5614  Food Safety and Security
FST 5624  Applied Food Microbiology and Sanitation
FST 5634  Epidemiology of Foodborne and Waterborne Disease
FST 4634  Epidemiology of Foodborne Disease

Drug Development

NANO 4314  Nanomedicine
BMVS 5324  General Neurochemistry
CHEM 4554  Drug Chemistry
BIOL 4554  Neurochemical Regulation (also ALS 4554)

Applied Plant Biology

PPWS 4504  Fundamentals of Plant Physiology
PPWS 5204  Principles of Plant Disease Management
PPWS 6004  Molecular Weed Science
PPWS 5524  Advanced Plant Physiology and Metabolism I and II
PPWS 5304  Plant Stress Physiology

Applied Microbiology

FST 5604  Advances in Food Microbiology
BIOL 5634  Microbial Physiology
BIOL 4164  Environmental Microbiology (also CEE 4164, CSES 4164, ENSC 4164)
BIOL 4604  Food Microbiology (also FST 4604)
BIOL 4644  Microbial Molecular Genetics
FST 4644  Fermentation Microbiology
CEE 5194  Environmental Engineering Microbiology
CEE 5124  Fundamental of Environmental Toxicology
FST 4414  Fermentation Process Technology and Instrumentation
FST 5624  Applied Food Microbiology and Sanitation

Food Science and Technology
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>FST 4405</td>
<td>Food Processing I and II</td>
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<td>FST 4406</td>
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<tr>
<td>FST 4504</td>
<td>Food Chemistry</td>
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<tr>
<td>FST 4524</td>
<td>Food Quality Assurance</td>
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<tr>
<td>FST 5664</td>
<td>Flavor Chemistry</td>
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