RESEARCH OPPORTUNITIES INCLUDE:

animal behavior, ecological and evolutionary biology, developmental neuroscience, host-pathogen interactions, microbes and infectious disease dynamics, parasitology, quantitative and systems biology, and more.
Welcome to the Graduate Program in the Department of Biology. The science of biology is exciting, challenging, and rapidly changing. To be competitive today, biology research scientists need a solid understanding of basic biological principles as well as specialized training in one or more specific areas of study. Because our Biology Faculty believes that all students who earn graduate degrees must have a broad-based background in biology, our graduate students are required to take three courses: BIOL 505 (Graduate Survival Skills), BIOL 506 (Integrated Biology Core Course), and Biostatistics. You also need to undertake state-of-the-art research in a specialized field of biology. Our Department, therefore, admits only a limited number of graduate students into its Program to insure a low student-to-faculty ratio. Members of your dissertation research committees may include scientists from both Department faculty and outside research laboratories (e.g., those at the Georgetown University Medical Center, National Institutes of Health, Smithsonian Institution, U.S. Department of Agriculture, or other universities). Today, there are diverse career options available to biologists with advanced degrees. You will choose a set of formal courses with the aid of your Academic Advising Committee and research mentor, if known. Most of our students choose careers in academics, government, or private industry after graduation. Whatever your career path, your ability to communicate both your ideas and research results are important for your professional success. There is no better way to learn those basic skills than teaching. Thus, all graduate students in our Department receive faculty-assisted education in the development of teaching skills, participate in at least two semesters of teaching a course in biology, and participate in the Center for New Designs in Learning and Scholarship (CNDLS) Apprenticeship in Teaching Program.

Both our Department and the Graduate School have a number of requirements that you must meet before you successfully complete your degree. This Graduate Student Handbook specifies Departmental requirements. Graduate School requirements are updated frequently online at http://biology.georgetown.edu/graduate/phdprogram/. Therefore, if you are uncertain about a requirement, please ask a member of the Committee of Graduate Students and Studies (CGSS). We welcome you to our Department and hope that your endeavors here will be highly productive and rewarding. New students please read this entire Handbook ASAP and retain it for your reference.

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A. LEARNING GOALS

The goals of the Ph.D. program are for the students to be able to:

1. **Display diversified knowledge of biological concepts, theories and research techniques covered by the core courses and in each student’s area of specialization**
   a. Integrate knowledge across biological sub-disciplines by considering key concepts from different biological perspectives.
   b. Demonstrate ability to derive hypotheses (based on theory) and testable predictions across biological sub-disciplines.
   c. Demonstrate knowledge of form, function, mechanism, organization, scale, hierarchy, diversity and evolution.
   d. Show mastery of subject area as demonstrated by course work, qualifying and comprehensive exams and thesis defense.

2. **Integrate new knowledge into existing scientific frameworks**
   a. Interpret, evaluate, and critique scientific text, primary literature and seminars
   b. Structure and contextualize understanding with proper references to literature
   c. Speculate on significance of scientific data and possible future directions
   d. Employ a multidisciplinary approach to biological research

3. **Engage in and conduct original research**
   a. Use texts, primary literature, presentations and mathematical models to develop scientific hypotheses and predictions based on those hypotheses.
   b. Appropriately design and perform original experiments and/or collect empirical data in order to test hypotheses
   c. Organize and interpret data to evaluate hypotheses and place findings into an intellectual framework to plan further experiments
   d. Use computers in data acquisition and processing and use available software as a tool in data analysis
   e. Use standard laboratory equipment, modern instrumentation, and classical techniques to carry out experiments.
   f. Know and follow the proper procedures and regulations for safe handling and use of chemicals.

4. **Represent and interpret data in quantitative and statistically meaningful forms**
   a. Construct and interpret visual representations of quantitative data
   b. Use probability and statistical analyses to evaluate and interpret data

5. **Communicate scientific understanding in oral, visual, and written forms**
   a. Ability to effectively communicate scientific information, concepts, theories and methods to professional colleagues (specialists), biologists, students and the public.

6. **Appreciate and practice ethical conduct in the application of science** (see NAP.EDU “On Being a Scientist” (1995) including
   a. Experimental techniques and the treatment of data
   b. Treatment of human and non-human animal subjects
   c. Values in science
d. Conflicts of interest

e. Publication, openness, data access

f. The allocation of credit

g. Authorship practices

h. Error and negligence in science

i. Misconduct in science and responses to violations of ethical standards

j. The role of scientist in society and social aspects of scientific pursuit

7. Develop a skill set and research record such that each student can secure employment in a place where he/she can apply the skills and knowledge acquired during the program. These places include colleges and universities, federal agencies, private companies, and non-governmental organizations.

B. THE ACADEMIC CALENDAR

Georgetown University is organized around fall and spring semesters. The fall-term classes generally start the Wednesday (which is considered a Monday!) before Labor Day and exams are given in mid-December. The second term starts in early January and finishes in mid-May. Graduate students typically don’t take classes during the summer but devote that time to research. Please see the academic calendar link at http://registrar.georgetown.edu/academic-calendar for details on holidays and breaks.

C. FINANCIAL AID

The Department of Biology endeavors to provide full financial support for graduate students in its Ph.D. program. The stipend for 2017-2018 is $32,000 which is paid out biweekly, throughout the year. Full financial support allows students to focus on class work, research and writing; thus, outside employment is not allowed, except under special circumstances.

The Graduate School currently commits two years of support for all admitted Ph.D. students; this is generally the first two years but the years can be split if there is outside support. Support for biology graduate students in subsequent years is provided by a combination of Department funds, faculty research funds (i.e., grants), and other fellowships or grants to the student. Stipends provided by the Graduate School or the Department of Biology in years 2-4 are considered service fellowships, and students are required to serve as teaching fellows. Stipends provided from other sources (faculty grants or external fellowships) are considered research fellowships, and teaching is not required. Support provided in the 5th year – whether departmental, grant or fellowship – is considered non-service (i.e., no teaching) because the student is expected to work solely on the completion of his/her dissertation by the end of the 5th year.

As noted above, fellowships or grants to fund research can be attained directly by graduate students. The Department expects students to take an active role in attaining these funds by applying for external grant and fellowship support. You should discuss possible opportunities for external fellowship support
with your adviser. The National Science Foundation Graduate Research Fellowship Program (NSF GRFP) Award, NIH F-32 Predoctoral Award, and the National Defense Science and Engineering Graduate Fellowships are among those that support graduate students. Obtaining these awards is highly prestigious and brings you additional compensation beyond the value of any monetary reward. An excellent database of available fellowships can be found at http://www.gradschool.cornell.edu/fellowships/.

MS students are not generally provided with graduate school fellowships. They may occasionally receive limited financial support as teaching assistants.

The IRS may consider your graduate student fellowship to be taxable income, whether or not Georgetown University withholds taxes from your checks. You are encouraged to consult a tax attorney or accountant for advice about paying your taxes, including estimated taxes. Further information on taxes is available at http://finaid.georgetown.edu/apply-now/graduate/#IRS_Retrieval_Section.

D. REGISTRATION

Obtain your net ID (your email user name) and password. Check with the Biology Office (Reiss 406) for information about this.

The Biology Office in Reiss 406 should have all the materials you need for registration, including your net ID and the Schedule of Courses. If the Biology Office does not have your net ID, please go to the Graduate School Office (302 ICC) to be cleared for registration.

Select courses over the summer after discussions with your advisor and the Chair of graduate studies.

Register via the Web in “MyAccess+”
https://myaccess.georgetown.edu/pls/bninbp/twbkwbis.P_WWWLogin

Give a copy of your course schedule to the Biology Program Administrator, Dan Isaac (di75@georgetown.edu, 428 Reiss).

Complete your I-9, W-4, and local tax forms. See the Biology Administrative Officer, Liz Goodloe, about those forms.

1. ACADEMIC ADVISING

As described above, biologists need a solid understanding of basic biological principles as well as specialized training in a biological sub-discipline. Accordingly, Biology requires you to take a core series of three (3) courses that are designed to provide you with a broad-based, multi-disciplinary biological
background. These courses are Graduate Survival Skills (BIOL-505), Integrated Biology Core Course (BIOL-508), and biostatistics (there are several that will fit this requirement). You may also take specialized courses in your sub-discipline that your advisers help you select. Note that a large number of graduate courses are also available through the consortium of local universities. Please consult their listings in addition to those at GU (see below).

Prior to the beginning of the fall semester, each new graduate student will meet with members of the CGSS. With your committee members, you will discuss your interests and career plans, review your transcript(s), and identify courses that you should take. At the end of this meeting, you should have your “academic plan” for your first year. By the end of your first year, you should have selected a research mentor. Members of your Dissertation Committee are selected and invited during the second year; they will advise you academically and scientifically.

2. FULL-TIME STUDENTS

Full-time students must take a minimum of 9 credit hours per semester. If you do not register for at least 9 credits in formal courses, you should also register for Thesis Research BIOL 999-03 to ‘top-off’ your credits to 9 and allow you to maintain full-time status. After you have reached your 16 credit maximum and you are not taking other courses, you should enroll in Thesis Research BIOL 999-01; once this is done, you should be automatically enrolled in each subsequent term until you graduate. Please see the Graduate School Catalog for description of half-time and quarter-time status. Generally, full-time status is required to maintain student loan deferment, student visas and to receive health insurance.

3. COURSE SELECTION AT GEORGETOWN AND ELSEWHERE

Graduate Courses at Georgetown

In Biology: Courses that are numbered above 500 are designed for graduate students (undergraduate students may petition for entry into these courses) and biology courses that are numbered from 350 to 499 are open to both graduate and undergraduate students. Any of these courses would be acceptable for enrollment. In some cases, you may take an undergraduate course (courses with numbers lower than 350) for graduate credit; however, you and your advisers should carefully consider that option: there is a limit of 8-cr undergraduate course credits that apply for graduate credit, you must obtain approval from the course instructor(s) and the Dean of the Graduate School prior to taking such a course (not retroactively), the course instructor must specify the additional work required from you in order to receive graduate credit (e.g. a term paper or other activities), and you cannot register during pre-registration but instead must use an Add/Drop form during the first week of classes. Graduate fellowships do not pay for non-science courses (English as a Second Language, etc.)

- Course BIOL 999: section numbers indicate status
  - Section 01, take this when all classes are complete
  - Section 03, take this to ‘top-off’ credits to bring you up to full time status of 9-cr.
- Numbered 500 and greater: graduate level courses offered by our department, some listed:
o BIOL-505 Graduate Survival Skills, a seminar-style graduate course that covers foundational professional skills necessary for success in graduate school and for careers beyond. **This is a required course.**

o BIOL-508 Integrated Biology Core Course, a seminar-style graduate course that surveys faculty research projects in the Department of Biology and examines the biological concepts that link sub-disciplines. **This is a required course.**

o BIOL-514 or BIOL-516, journal clubs. BIOL-514 is the EEB (Ecology, Evolution and Behavior) journal club and BIOL-516 is the MCB (Molecular and Cellular Biology) journal club. Students can take either one for 1-cr to apply to their degree (section 01) and, in subsequent terms, take it for 0-cr (section 02)

- Numbered 350 and above: courses that are open to grad and undergrad students, **some listed:**
  - BIOL-358 Immunology
  - BIOL-363 Cell Biology
  - BIOL-364 Microbiology
  - BIOL-367 Population Genetics
  - BIOL-376 Developmental Neurobiology
  - BIOL-379 Genomics & Bioinformatics
  - BIOL-386 Experimental Design and Analysis for Biologists
  - BIOL-390 Molecular Biology
  - BIOL-422 Modeling: Biological Populations

- Numbered less than 350: undergraduate courses taken only with permission (see above).

**In Other Departments:** Students may also enroll in courses offered by other University departments such as the Department of Biochemistry, Molecular and Cellular Biology, the Department of Biostatistics, Bioinformatics and Biomathematics, the Department of Microbiology and Immunology, and the Department of Neuroscience. These departments offer a variety of courses numbered above 500 that may be taken with the consultation and approval of your advisers. See the bulletin for current offerings (as these may change), some courses are listed below:

- Biochemistry, Molecular and Cellular Biology: BCHB-501 Biochemistry
- Biostatistics, Bioinformatics, and Biomathematics: BIST-501 Experimental Design & Analysis
- Microbiology and Immunology: MICB-612 Immunology
- Neuroscience: NSCI 501/511, Cellular and Molecular Neuroscience [IPN program core course, required for some biology students, to be taken during the 2nd year]

**Courses outside Georgetown University:** You may take a course(s) taught at Consortium Universities (University of Maryland, George Washington University, et al.), federal agencies (for example, the FDA, NIH, and USDA), and biological field stations. Graduate fellowships will cover science courses in the consortium. Please consult with your adviser before doing so. Also, read the specific information below regarding M.S.-Ph.D.-program requirements and restrictions for the number of allowable credits. Students studying ecology, evolution and behavior will typically take a series of courses in applied
statistics from the University of Maryland (UM), and some take courses offered by the Entomology Department at UM as well.

- Biostatistics I (BIOM 601) - Estimation and hypothesis testing, t tests, one- and two-way analysis of variance, regression, analysis of frequency data. Lecture emphasizes the use and limitations of these methods in biology, while the laboratory emphasizes the use of statistical analysis software for the analysis of biological data (4 credits).
- Biostatistics II (BIOM 602) - The principles of experimental design and analysis of variance and covariance (4 credits).
- Insect Ecology (ENTM 612) - An advanced course in population and community ecology, plant-insect interactions, and insect biogeography. Emphasis on current entomological literature (3 credits).

Audit or Pass-Fail Options
Students must take courses for grades. However, some courses are offered on a pass-fail basis only; you may register for these courses directly. You may not register for audit or pass-fail courses during registration. During registration, sign up for a course for credit. Then, obtain an add-drop form, fill it out, and hand it in to the Graduate School Registrar. Graduate School fellowships will not pay for audited courses.

4. ADDITIONAL GRADUATE SCHOOL REGISTRATION REQUIREMENTS

The Graduate School has a number of registration requirements that must be met before your registration is complete. These include, but are not limited to, proof of immunization against select childhood diseases, IRS forms for foreign students (F-1 and J-1), and submission of an “I-am-here-payment” card. All graduate students are required to have medical insurance throughout each academic year. Thus, PLEASE read the Graduate School’s online catalog at https://grad.georgetown.edu/academics/registration before starting the registration process. Graduate students are responsible for keeping abreast of Graduate School regulations and deadlines.

Pre-registration
At the end of an academic semester, continuing students pre-register for the next semester. The Department encourages each student to plan his (her) courses for an entire school year at the beginning of each fall semester. Discuss pertinent academic matters with your adviser, committee members, and CGSS members before registration. Pre-registration steps are essentially the same as outlined above.

E. INFORMATION FOR FIRST-YEAR STUDENTS

There are a range of seminars, presentations, journal clubs, workshops and other events to expand and deepen your understanding of biology as well as providing forums to practice giving presentations.
1. DEPARTMENTAL SEMINARS

Each semester, the Biology Seminar Committee invites scientists who are addressing contemporary biological questions to give research seminars. These informative seminars cover a variety of topics of interest to people in the department. All faculty members and graduate students are expected to attend those seminars, held on Thursdays, 12:30 - 1:30 p.m.

Talks by prospective faculty (job candidates) are also generally scheduled during this time. These are particularly valuable since many of you will on the job market soon. The Department also strongly encourages graduate students to suggest names of speakers to be invited and host a speaker once per semester. In addition to departmental seminars, a wide variety of seminars on the Main and Medical Campuses are of interest to members of the Department. Check the Dean’s events link at http://gumc.georgetown.edu/ for Medical Center seminars.

2. GRADUATE RESEARCH SYMPSIUM AND WORK-IN-PROGRESS SEMINARS

After the first year, each graduate student presents a research seminar annually to our Department. These are short talks (10-15 minutes) presented during our Graduate Research Symposium, where students, faculty and post-docs can devote full attention to each person’s research. They are similar to the format that most conferences use and thus give students and post-docs a chance to practice short conference presentations.

The 3rd, 4th and 5th year students also present their work in a longer format (40-45 min. talk with 10-15 min. for questions) on Fridays at 3:30 p.m. Fifth year students who will graduate during the fall term of the fifth year are excused from this longer seminar because of the timing of their dissertation defense. The longer format talks allow students to present their work in depth and become practiced for both their defense and for future job talks.

3. RESEARCH-GROUP MEETINGS AND JOURNAL CLUBS

Most research in the sciences is collaborative, involving students, staff and faculty at multiple levels and often across departmental units. To better understand this process, new graduate students are required to attend group laboratory meetings (regular meeting of faculty and students working in a specific research laboratory) in addition to one of the journal clubs. You may ask your academic advising committee, other graduate students, or the CGSS for additional information because these activities may not be formally announced. If you are not already committed to a particular laboratory, attendance at lab meetings is a good way to learn about the workings of a lab and meet everyone involved.

4. LABORATORY ROTATIONS

Graduate students are welcome to perform research rotations in Biology research groups to learn about and undertake research and decide which group to join for dissertation research. You should contact
appropriate lab leaders (professors) to set up your lab rotations. Further, in advance of the rotation, you and the lab leader should discuss and write down the detailed expectations for your work in the lab rotation. You may wish to put them in writing. A student should plan to complete rotation projects and select a dissertation lab by March in their first year. Students should be aware that laboratories in which multiple students are planning to rotate in a single year may not commit to accepting any students until all students have completed rotations. Each rotation lasts for 7 weeks (half a semester) and begins at the start of the academic year. Note that some faculty members may not be accepting students to join their group and will not participate in rotations. In 2017, the first rotation begins August 30 and ends October 20, the second rotation runs from October 23 – December 8 and the third rotation runs from January 10 – March 2.

5. DESKS, TELEPHONE ACCESS, COMPUTER AND OTHER SUPPORT SERVICES

Upon arrival, each graduate student will be assigned a desk within one of the research laboratories. By having space within a laboratory, a new graduate student has an opportunity to interact daily with other graduate and undergraduate students, research technicians, and staff. Graduate students will have access to a telephone, a secure place to leave valuables, a computer and printer, etc., and have a quiet place to hold office hours with other students. Once a graduate student selects a research mentor, he (she) will transfer to that mentor’s laboratory.

Mail Box
Each graduate student has a mailbox in the Biology Office (Reiss 406). Please check it often for outside, Georgetown University, and departmental mail.

Graduate Student e-mail and Bulletin Board
Important information for graduate students is sent by group e-mail via listserves. Please inform the Graduate Administrative Assistant (Dr. Dan Isaac) if you discover your name is not on the e-mail list. If you have multiple email addresses, please check regularly or set up automatic forwarding.

Access to Reiss Science Center and Regents Hall on Weekends and after Hours
Reiss Science Building and Regents Hall are locked after hours for safety, but we encourage you to keep working in the evenings and on weekends. In order to obtain access to the Reiss Science Center or Regents Hall after hours, please ask the Biology Administrative Officer in Reiss 406 to submit your name to the Security Office so that you can use your GoCard in the card readers at Reiss and Regents entrances.

Lounges and Lunch Rooms
There are several places in Regents Hall and in 436 Reiss where faculty, staff, and graduate students can relax, chat, and eat. If you store your food in the refrigerator, put your name on it. Do not put food in refrigerators or freezers in research or teaching laboratories! Please be sure to clean up after yourself and toss expired food items. This isn’t the job of the staff to clean up after graduate students;
occasionally unlabeled or questionable items will be discarded.

**Telephone Calls**
You should use Department telephones for making business and emergency calls. You should keep personal calls to a minimum on those phones. If it is necessary to make personal long-distance phone calls on a Department phone, please inform the Biology Accounts Analyst, currently Ms. Margaret Chung, who will provide you with the bill at the end of the month.

**Photocopying in the Biology Office**
The photocopy machines in Reiss 406 and in Regents Hall (3rd, 4th and 5th floors) are available to graduate students for copying material related to your research and graduate studies. However, if you photocopy material for personal use, please pay the Office Accounts Analyst $0.05 per page. If you have big jobs to print, please print these late in the day or evening so the printers/copiers are not tied up during peak hours.

**Security**
Unfortunately theft occurs throughout the campus throughout the year, especially during the winter holiday season and at the beginning of terms when new people are around. You should be especially careful to protect your property (backpacks, computers, books, I-pods, etc.), the equipment and supplies in the laboratories, and supplies and information in departmental offices. Keep your valuables in a safe place, and lock doors and desks when no one is around. Emergencies and thefts should be reported immediately to Campus Security (687-4343) and the Biology Office (687-6247). Campus Security can mark your laptop, etc., for security purposes. Also, be sure to keep valuables with you when you use GU libraries. Laptop thefts are frequent at GU.

6. STUDENT-FACULTY SOCIAL FUNCTIONS

Various informal receptions are held throughout the year to allow graduate students, faculty, and staff to interact in a relaxed setting and to develop departmental rapport. Those social events usually include a reception at the beginning of the school year to welcome new students, a holiday party, a WIPS party, regular social hours (once per month), and a refreshment period prior to departmental seminars. Graduate students often have refreshments with seminar speakers in the Leavey Center or at Epicurean.

7. SAFETY TRAINING FOR SCIENTISTS

Because graduate students are involved in research in departmental labs, teaching labs, or both, they must receive basic training in general lab safety. Basic chemical and biological safety training sessions are offered monthly by the Environmental Health & Safety Office in the Medical Center and in Regents Hall. Class times and registration are listed on-line for a class that fits in your schedule.

- **We strongly recommend that you complete the training class in September of your first year.** You
must complete one of these training classes by the end of your first semester.

- To satisfy this requirement you must provide a copy of the class completion certificate to the Administrative Officer in the Department of Biology in Reiss 406, currently Nof Al-Haj.

The United States Federal Government and the District of Columbia have a number of regulations regarding the conduct of research. Georgetown University must comply with all of the regulations in order to receive grant support. Thus, it is imperative that all graduate students are aware of, and comply with, the regulations (including disposal of trash and other waste). Some of the required training is listed below. Graduate students should discuss the regulations with their research mentors before beginning research in the laboratory. In addition, teaching assistants for certain courses may also require specialized training.

Research and Teaching with Laboratory or Wild Animals
Before you may use laboratory animals in either teaching or research, you must meet several requirements. First, all work, including the observation of behavior, involving vertebrates (fish, frogs, rats, mice, etc.) requires submission of an animal-use protocol to the Georgetown University Animal Care and Use Committee (GUACUC) and its approval by that Committee. Such approval is a prerequisite for the purchase of animals. Ordinarily, the protocol is submitted by the faculty member in charge of a course or of the research, and it must be signed by the faculty member and by the Biology Chair. Second, your name must appear on the protocol as one of the persons responsible for doing the work. Third, the GUACUC will require that you complete a training course on the use of laboratory animals given by the veterinarians at the GU Research Resources Facility (RRF) as a condition of approval of the protocol. You also need to complete health certification forms.

It is extremely important that you adhere to these requirements. An accreditation committee visits Georgetown periodically, the USDA makes unannounced inspections of our facilities and labs twice each year, and both will ask to see records of animal use. Violations can jeopardize GU’s accreditation for animal use. Please consult the big red vinyl-covered "Manual for the Care and Use of Laboratory Animals at Georgetown University," which is kept on the Administrative Officer's desk in the Biology Office (406 Reiss), or see Professor Huang (Regents 406) if you have any questions.

Safety in Laboratories, The Chemical Hygiene Plan, Disposal of Hazardous Substances, and MSDSs
You should be aware of any hazardous materials (radioactive, toxic, etc.) in laboratories where you work and know the proper way to handle any hazardous materials you use in your research. All laboratories should have a printed Chemical Hygiene Plan and a binder containing Material Safety Data Sheets (MSDS). Learn where these are kept within your research laboratory and become familiar with their contents. After consulting the appropriate manuals, make sure you ask the professor in charge for additional instructions if you have questions. Never store food, eat or drink in a laboratory.

The Office of Radiation Safety
All students, who have desks in laboratories where radioactive material is used, must become familiar
with the nature of the isotopes being used and sign the laboratory "non-user" form. All students who work with radioactive material must receive training by the authorized user prior to conducting experiments and take the Radiation Training Course as soon as possible. The Course is not optional; it is required by federal law.

**The Office of Biosafety, Human Blood-Borne Substances**

A few Department laboratories work with human pathogens. If you are conducting research in those laboratories or are TF for courses using human pathogens, you must take a special training course provided by the GU Medical School. This course must be taken annually.

**F. YOUR TEACHING EXPERIENCE AND TEACHING FELLOWSHIPS (TFS)**

As noted above in the introduction, the Department not only seeks to provide you with an outstanding education in research, but also to train you in how to become an excellent teacher. Some graduates will enter academia, whereas others will find careers in government, private industry, public policy, or elsewhere. Whatever career path you take, your ability to communicate both ideas and research results is key to your professional success. There is no better way to practice these skills than by teaching.

**1. CNDLS AT PROGRAM - TEACHING BIOLOGY: PEDAGOGY AND PRACTICE**

Excellence in teaching requires thought and preparation and is made easier by having a conceptual framework on which to build your actual teaching experiences. No matter how much experience you have had with teaching, there is always more to be learned. In order to facilitate your transition from teaching fellow to course instructor, you are required to participate in 5 workshops of the apprentice in teaching (AT) program offered by CNDLS (Center for New Designs in Learning and Scholarship; see https://cndls.georgetown.edu/atprogram/upcoming-workshops/). After taking the course, you need to provide documentation to the graduate administrator (presently Nof Al-Haj) to be placed in your file. In your first year before you serve as a TF, you must take “Introduction to Teaching Resources” (offered at the beginning of each semester by CNDLS) and “Effective Classroom Interaction” (offered each semester). This should be followed by “Assessment and Grading” (offered each semester) and two of the workshops below:

- Syllabus Design (offered each semester)
- The Teaching Portfolio
- Bringing Curricula to Life and Life to Curricula
- "Did you say what I think you said!?" Facilitating Discussion on Challenging Topics
- Learning Styles
- What does “diversity in the classroom” mean?
- Online Writing
- Teaching science labs
You have the option of completing the AT program and receiving a teaching certificate and a notation on your transcript. This requires completion of the following requirements, which is two workshops beyond what the Department of Biology is asking you to do:

- Attend an introduction to teaching resources at Georgetown, held at the beginning of each semester
- Attend an additional six workshops (4 core; 2 elective)
- Complete four authentic teaching tasks by submission deadlines
- Submit a Program Registration Form to the Graduate School

If you are interested in doing this please see the CNDLS website.

2. TEACHING FELLOWSHIPS

Teaching fellowships are an important part of your graduate training. All students are awarded at least two Teaching Fellow (TF) assignments, usually in the second year, as an opportunity to teach in different environments and to hone their skills. Usually, an assignment consists of responsibility for leading a major course activity (for example, leading a discussion group, teaching a laboratory section, etc.), attending all lectures, holding office hours for a limited number of students and grading exams, papers, or both. Each teaching assignment is expected to take approximately 10–12 hours per week. Students should meet with relevant faculty before the semester begins to discuss specific goals and expectations for that semester. The CGSS attempts to assign equivalent teaching loads to all Teaching Fellows across their graduate careers. Thus, while some semesters may have a more demanding teaching load than others, the CGSS attempts to balance this variation over your two required assignments. Students should inform the course instructor or Department Chair if their teaching assignments require more than 15 hours per week on the average. Students will also teach in years 3 and 4 if their fellowships are provided by the graduate school or biology department.

3. TF EVALUATIONS

Graduate students and biology faculty have developed a formalized mechanism for evaluation of graduate student performance as a TF. To this end, the Department uses a uniform TF evaluation form distributed to students at the end of a course. This evaluation is intended to be helpful and to provide graduate students with constructive feedback on their teaching. The current TF evaluation form was developed by graduate students and CGSS faculty to cover a broad range of general questions; however, like other standardized forms, it may not be ideal for all courses. The CGSS welcomes any comments from graduate students regarding possible changes to make the feedback form more useful. Faculty also can add questions on teaching fellows to the standard course evaluation form administered by the Registrar; this modification is made about halfway into the semester.
Completed TF evaluations will be held by the professor until final grades are submitted (in the same way faculty evaluations are held by the GU Registrar until grades are submitted). The evaluations should be discussed with the professor responsible for the course and will become part of your academic file (meaning that faculty will provide the Graduate Program Administrative Assistant with a copy of the evaluations for their academic files). TF evaluations may be used by faculty when writing recommendation letters and as part of your application package for a position when you are nearing graduation and thereafter.

G. SAMPLE SCHEDULE FOR EARNING A PH.D.

This table indicates the "benchmarks" students need to meet in order to complete the degree in the specified time. This table presents one possible route for completion of the Ph.D. There are, however, many ways to reach that goal. Notably, while we have listed the benchmarks for obtaining a PhD, success in your career path will also depend on your ability to disseminate your research via publications, presentations at national meetings, etc. One published manuscript is minimally required for the Ph.D. degree.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall semester</th>
<th>Spring semester</th>
<th>End of academic year &amp; summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>– Take BIOL 505, BIOL 999, 1–2 additional courses*</td>
<td>– Take BIOL 508, BIOL 999, 1–2 additional courses*</td>
<td>– Enroll in BIOL 999</td>
</tr>
<tr>
<td></td>
<td>– Attend departmental seminars and WIPS talks</td>
<td>– Take Ph.D. Qualifying Exam by April 1.</td>
<td>– Perform research</td>
</tr>
<tr>
<td></td>
<td>– Attend laboratory meetings and journal club</td>
<td>– Attend departmental seminars, and WIPS talks</td>
<td>– Establish initial Ph.D. Dissertation Committee</td>
</tr>
<tr>
<td></td>
<td>– Do lab rotations, or select a mentor</td>
<td>– Attend lab meetings, journal club</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Take BIOL 999 and BIOL 999-01 (0-cr)</td>
<td>– Finish lab rotation, select mentor</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>– Take additional courses, statistics, BIOL 999</td>
<td>– Take BIOL 999, complete courses</td>
<td>– Perform research</td>
</tr>
<tr>
<td></td>
<td>– Attend departmental seminars and WIPS talks</td>
<td>– Attend departmental seminars and WIPS talks</td>
<td>– Have committee meeting</td>
</tr>
<tr>
<td></td>
<td>– Attend lab meetings and journal club</td>
<td>– Attend lab meetings, journal club</td>
<td>– Submit Dissertation Proposal Form</td>
</tr>
<tr>
<td></td>
<td>– Teaching assignment 1</td>
<td>– Present ‘short talk’ at Research Symposium†</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>– Take BIOL 999-01 (0-cr)</td>
<td>– Complete teaching assignment 2</td>
<td>– Begin to contemplate future options.</td>
</tr>
<tr>
<td></td>
<td>– Take Comprehensive Exam by Dec. 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Attend departmental seminars and WIPS talks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Attend departmental seminars and journal club</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† Symposia are optional; short talks are mandatory.
H. GENERAL PROCEDURES FOR OBTAINING A PH.D.

1. SUMMARY OF REQUIREMENTS

For students with Bachelor or M.S. degrees, satisfactory completion of:

- A minimum of 3 years in residence; GU allows a maximum of 7 years to complete your degree.
- A minimum of 16 graduate-course credits, excluding research credit (e.g., BIOL 999)
- Completion of BIOL 505, 508, and biostatistics (which all count toward your 16-credit requirement)
- Completion of CNDSL AT requirements
- Teaching experience as a TF for at least two (2) semesters
- A passing grade on the Ph.D. Qualifying Exam (completed by April 1 of the first year)
- Successful completion of the Ph.D. Comprehensive Examination (taken no later than December 15 your third year)
- Ph.D. Dissertation with successful defense
- Departmental Dissertation Seminar
- Submission for publication of at least one empirical first-author manuscript based on your dissertation research in a scientific peer-reviewed journal. (Note some exceptions are made for large collaborative group publications —e.g., common in computational genomics, but it is important that the student has a substantial and independent role in such publications.)
2. MINIMUM TIME REQUIREMENTS

The minimum time requirement for obtaining a Ph.D. is six (6) regular semesters in residence. A part-time student must spend at least one academic year in residence in the Department as a full-time student.

3. CREDIT AND COURSE REQUIREMENTS

Ph.D. students may take no more than 8 credits with numbers below 350 for graduate credit, and the proper paperwork must be completed to obtain graduate credit. (Please see “Registration” above). Because only 16 course credits are required for the Ph.D., you should only occasionally use undergraduate courses for graduate credit.

In the first year, a Ph.D. student may register for Thesis Research (Biol 999-03) for 0 credits. Biol 999-03 serves as a “top-off” course and thus will top-off your credit hours to provide full time status. Incoming students may participate in Biology Research with different research laboratories, preferably during the first two semesters of enrollment. You should choose your dissertation lab no later than the end of your first summer at GU.

Once you have completed your 16 credits you should enroll only in BIOL 999-01 for 0 credits or if you take a course then you can also register for 999-03 for 0 credits.

4. TEACHING REQUIREMENTS

Each Ph.D. student is expected to attend teaching workshops and serve as a TF for at least two (2) semesters and a maximum of six (6) semesters (see above).

5. PH.D. QUALIFYING EXAM

The purpose of the qualifying exam is to teach the scientific method through the preparation and defense of a grant proposal, as well as to identify areas in which a student is deficient. Deficiencies can be made up by course work or teaching (the committee will recommend remedies). The qualifying exam is taken by all Ph.D. candidates, including those entering our Department with advanced degrees, and must be taken by April 1 in the spring semester of the first year (i.e., nearly the end of the second semester). For students who do not pass the exam on the first attempt, a retake must be completed by May 31 of the first year. Dates will be adjusted for students who matriculate in the spring term.

Exam Goals

Goals of the exam process are the following:
a. Students will become experts on a topic, integrating information from diverse fields, through reviewing scientific literature.

b. Students will learn how to develop testable hypotheses.

c. Students will investigate research techniques and experimental approaches, learning about the strengths and weaknesses of each technique.

d. Students will create a unique, synthetic study of a particular scientific area.

e. Students will write and present their ideas, concisely, clearly and effectively such that an expert or novice can understand the basics of the field, what you propose to do, and why it is important.

Format of the Exam

The exam consists of two parts: a written proposal and an oral defense.

Written proposal: The written exam is typically a mock grant proposal that consists of background information including the identification of gaps in knowledge, specific aims (hypotheses or questions) designed to fill the gaps, proposed experiments to address those aims, expected results and potential research problems. The proposal should be 5-10 single space pages with 1-inch-wide margins; figures and tables are included within the page limit, but references are not included in the page limit. Additionally, a one page Proposal Summary will be written that summarizes the background information, explains the significance of the problem, provides the specific aims and rationales for experimental approaches.

Much of modern Biology research occurs from interdisciplinary perspectives; thus, the faculty of the Department of Biology thinks that it is very important to learn how to approach scientific problems from a variety of perspectives. When choosing a topic, it is important to recognize that it is difficult to write a proposal on a system of which little prior work has been done, whereas it is likely to be easier and more educational to write a proposal on a system that is at least a little more developed. Be sure to develop the topic in your first semester, propose it to your committee (e.g., with an abstract and/or outline) and then begin researching and writing.

The primary goal of the Qualifying Exam is to determine the ability of the student to work independently, synthesize the literature, and propose a novel question. Thus, the topic of the proposal must not be on a topic that the student or their mentor’s lab is currently investigating. In other words, the subject should be outside the area of the student’s and lab’s research and should be agreed upon by the Ph.D. Qualifying Exam Committee and approved by CGSS. The goal of this requirement is to ensure that the proposal reflects the student’s ideas rather than those of the PI in whose lab the student is working, and also to encourage the student to obtain breadth of knowledge by exploring research topics outside of the mentor’s research program. Inevitably, there is variation in
how this language is interpreted. Every qualifying exam is a unique case and it will not be possible to establish completely uniform standards. Nevertheless, there are general guidelines that can help determine if the topic of an exam is sufficiently distinct from ongoing work in a mentor’s lab that it is suitable for the Qualifying Exam. For example, the topic of the exam may address a similar theoretical problem to work being conducted in the mentor’s lab, but the proposed work must address that theoretical problem using a different analytical or experimental approach or in a different experimental system. Alternatively, the topic of the exam may involve using the same experimental system as in the mentor’s lab, but in that case the proposed work must address a different theoretical question than is currently being pursued in the mentor’s lab. Ultimately, the Qualifying Exam Committee and CGSS are responsible for approving the topic of each student’s exam proposal. The student must submit an abstract of the Qualifying Exam proposal topic by the Monday following Thanksgiving for approval by CGSS (submit to the Director of Graduate Studies).

**Oral Defense:** The oral defense will take place in front of the Ph.D. Qualifying Exam Committee. Students will pick their committee members, generally choosing faculty with expertise in the topic or experimental approaches used. This committee will be composed of at least three Biology faculty members. Your research advisor, if you have chosen one during your first year, will be the third member; if a research mentor hasn’t been selected, then students should select one of the faculty members whose labs they rotated through.

**Support and help in the preparation and defense of the proposal**

All students should feel free to discuss the content, format, and scientific approaches of their proposals with Biology faculty, their advisors, lab members, and examiners. However, the ideas (aims, approaches, questions) should be developed by the student not the advisor, and the first draft should be submitted to all committee members at the same time. Please take into consideration that it will usually take faculty at least 2 weeks to provide comments on draft versions of your proposal.

**Grant examples.** Students should solicit sample qualifying exam proposals from students to serve as exam models (especially those who passed with distinction).

**Progress meetings with exam committee.** Students will meet once with the exam committee prior to the defense (see time line below). Note that it is the student’s responsibility to organize Ph.D. Qualifying Exam Committee meetings; this includes contacting the Ph.D. Qualifying Exam Committee members to find a time when your entire committee can meet. One of the Ph.D. Qualifying Exam members is required to summarize the meeting at least once per year.

**Mock defense.** The Biology faculty recommends that each student organize a practice exam defense. This would entail the recruitment of graduate students or other lab members to read and critique the proposal and then serve as examiners in a mock exam setting. Faculty and exam committee members should not be involved in this mock defense.
**If English is not your first language.** Any student for whom English is not his/her first language will need to write and speak sufficiently clearly to convey the ideas in the proposal. These students should visit the Writing Center and/or ask another graduate student or lab member to review and edit the English of the proposal.

**Time table**

**Fall semester.** Start to investigate topics for the exam and identify gaps in knowledge. Rephrase the gaps as potential questions that you’ll want to answer.

**November.** (1) Chose the members of your Qualifying Exam Committee and arrange for a time to meet to discuss your ideas for the proposal (early in the month). (2) Inform CGSS of the composition of your committee and submit the one-page first draft of the proposal summary page (the Monday following Thanksgiving). You should make substantial progress on your proposal so you can submit a draft by February 1 (see below).

**January – March.** Actively work on proposal- iterate drafts and seek input from your peers.

**March 1:** Last date for changes to the composition of the Ph.D. Qualifying Exam Committee.

Two weeks before your final exam, give your Ph.D. Qualifying Exam Committee the final draft of your exam.

**April 1.** On or before this date, take your oral exam on your proposal.

**Standards for Evaluation**

**Criteria.** This exam is rigorous at both the theoretical level (concepts, proposed experiments, etc.) as well as at the presentation level (written material and oral defense). In order to pass, students must demonstrate that they can write clearly and logically, and be able to orally defend their proposal. Criteria for passing your exam include:

- a. Understanding of your proposal area from factual and conceptual perspectives.
- b. Application of relevant concepts to your grant proposal.
- c. Logical synthesis of relevant concepts and facts.
- d. Ability to frame the novelty of the study in light of previous research
- e. Development of a well-defined experimental approach
- f. Clear link between proposed experiments and research questions
- g. Oral explanation of your proposal.
Grading. You can earn a pass, pass with distinction, pass with remediation, or fail.

“Pass” and “Pass with Distinction” are noted in your file and allow you to continue to pursue your PhD.

“Pass with remediation” indicates that you have an academic deficiency that your Ph.D. Qualifying Exam committee believes can be remedied with a specific action (for example, completion of a specific course) and your Ph.D. Qualifying Exam Committee will specify that action. If the remediation is not completed satisfactorily, the committee might recommend that you pursue a M.S. degree or withdraw from the program.

“Failure” indicates that you have failed the exam. Your Ph.D. Qualifying Exam Committee may decide (a) that you have passed it at the M.S. level and that you may retake it at the Ph.D. level. If you retake it at the Ph.D. level and pass, you can continue in the program. However, if you fail a second time, you will be dismissed from our Graduate Program; (b) you passed the exam at the M.S. level and your Ph.D. Qualifying Exam Committee allows you to continue on to pursue a M.S. degree. Unfortunately, the Department of Biology cannot provide a fellowship for completion of a terminal M.S. degree and you will be charged tuition; (c) your performance was insufficient for passing at the M.S. level and you will be dismissed from the program.

Non-compliance. The graduate student’s stipend will be suspended if the exam is not completed within 12 months after the start of the student’s graduate career at GU. Upon completion of the exam the stipend will be reinstated. A request to extend the deadline of your Ph.D. Qualifying Exam must be submitted in writing to the CGSS prior to April 1 deadline of the year of the Exam; the reasons must be compelling to receive an extension.

6. PH.D. DISSERTATION COMMITTEE AND RESEARCH

By the end of your first year, you should select a research area and a mentor, who will help you select the other members of your Ph.D. Dissertation Committee. It must have at least four (4) faculty members at the time of your dissertation defense, including at least two (2) members from the Department and at least one (1) member from outside the Department. The chair of that committee will be the most senior faculty member of the committee excluding your faculty mentor. As soon as you establish your Ph.D. Dissertation Committee or if you change members, please notify the CGSS in writing. The composition of your Ph.D. Dissertation Committee is subject to approval by CGSS and the Chair. Your initial Ph.D. Dissertation Committee must be established no later than the end of your first year in the Department (including the summer term); the composition of the committee must be submitted to CGSS by Oct. 15 of the second year. The composition of your Ph.D. Dissertation Committee is fluid, especially in your first few years, and can be changed as your research develops.
Your Ph.D. Dissertation Committee is responsible for your academic program, training, and research, as well as conducting your Ph.D. comprehensive examination and dissertation defense.

Your committee **must meet at least once each year** to evaluate your overall progress towards your degree. Students should schedule committee meetings and ensure committee members can attend. At least three members of the Ph.D. Dissertation Committee must be present to constitute a Ph.D. Dissertation Committee meeting. An affirmative vote by a majority of the committee is required to designate a dissertation as acceptable for defense and that a student passed his (her) defense. Immediately after the meeting, minutes from the meeting should be provided by the committee members to the student and a copy placed in the student’s record in the Biology Office. The minutes should include: date, names of Ph.D. Dissertation Committee members present, and a list of the important decisions and recommendations made. The contents of the minutes should be confirmed by all committee members in attendance. Please provide this information to the Director of Graduate Studies and the Graduate Administrative Assistant so that it can be included in your file.

A student is required to conduct at least 50% of his (her) dissertation research in the Department, which may include time spent doing field work under the direction of a faculty member in the Department. Collaborative research or training experience may be arranged with scientists outside of the Department (including off-campus research labs), subject to approval by your dissertation committee and the DGS. Research accomplished by a student as a paid employee (either on or off campus) may not be used for a dissertation.

### 7. PH.D. COMPREHENSIVE EXAMINATION

You shall take your Comprehensive Exam after successful completion of the Ph.D. Qualifying Exam. The Ph.D. Comprehensive Exam is intended to assess your analytic and synthetic abilities in areas of biology pertinent to your goals as a scientist. The comprehensive examination may take different forms, such as a written grant proposal, written dissertation proposal, written subject exams, or a combination of such exams. Your committee will give you an oral exam related to the written material. The Ph.D. Comprehensive Exam often has preliminary data and may take the form of a full dissertation proposal or doctoral dissertation improvement grant (NSF style).

For maximum benefit to the student, the CGSS requires that the comprehensive exam be taken by Dec. 15 of the third year (i.e., at the end of the 5th semester). If a student does not pass the exam or obtain a waiver from CGSS by the beginning of the fourth academic year, he/she may not be eligible for a fellowship. A student who fails the exam on the first attempt will be allowed to revise and retake the exam. A second failure will result in dismissal from the program and occasionally an opportunity to complete a Master’s Thesis instead. However, fellowship support is generally not available to Masters students.

Once you have successfully defended your Ph.D. Comprehensive Exam, you advance to candidacy and must file your dissertation proposal with the Graduate School. You will not be eligible for some
fellowships unless you do this (see below).

Note: You must submit the dissertation proposal form to the Graduate School at least 1 week prior to your dissertation defense. However, you should submit this form immediately after passing the Ph.D. Comprehensive Exam. The form is available at: http://grad.georgetown.edu/academics/academic-forms/.

8. PUBLICATION OF PH.D. DISSERTATION RESULTS

You are required to prepare and submit at least one scientific paper based on your dissertation to a scientific journal. Learning to write such a paper is an important part of your education. Clearly, it is also highly beneficial for a new Ph.D. to have one or more papers published, in press, or both, in refereed journals before graduating. Most students opt for their dissertation to be a series of papers rather than traditional chapters. In this case, there is typically a short introduction, a review chapter, and a short conclusion/summary chapter, with at least two data-driven papers (i.e., chapters) in between. Because publications can take time (multiple revisions or resubmissions), we strongly encourage you to begin submitting papers as early as possible in your graduate career.

9. PREPARATION OF YOUR PH.D. DISSERTATION

Format Requirements from the Graduate School
Your dissertation MUST be in accordance with the directions in Georgetown’s Guidelines for Dissertation and Thesis Writers. One of the Associate Deans in the Graduate School will examine your dissertation (usually page by page) to verify that it conforms to the rules; therefore, it is extremely important that you follow the directions provided by the Graduate School carefully. It provides a checklist for submitting your dissertation.

Writing Your Dissertation
Writing your dissertation is very time-consuming. Before you begin to write your dissertation, you would be wise to (1) determine with your Ph.D. Dissertation Committee if you have enough data, (2) determine how to present your data, (3) discuss the format and contents of your dissertation with your adviser, (4) review the format regulations of the Graduate School, and (5) consult an excellent manual of scientific writing approved by your adviser. You should allow ample time for writing your dissertation, because it will take longer than you expect. It is important to get as much feedback as possible from your adviser as you are writing. Other members of your Ph.D. Dissertation Committee will choose which drafts they wish to read as you progress. Some may wish to see many drafts in progress, others may wish to see only later drafts that you and your adviser have edited well. You should keep your Ph.D. Dissertation Committee members well informed of your progress. The Department of Biology requires that at least two of your dissertation chapters are empirical (data-driven).

10. APPLICATION FOR THE PH.D. DEGREE
GU awards M.S. and Ph.D. degrees at the end of each month (except June). To be awarded a degree, you must file an Application for Graduate Degree via MyAccess by the first business day of the month in which you intend to graduate. (May is an exception, and other deadlines apply.) Instructions are available at: http://grad.georgetown.edu/academics/how-to-graduate/

11. ANNOUNCEMENT OF THE DEPARTMENTAL SEMINAR AND DISSERTATION DEFENSE

You must notify The Graduate School of your departmental seminar and dissertation defense times and date(s); this is a Graduate School requirement – all dissertation defenses are open to the public. Because the degree is certified by the Department of Biology, it is important that all members of the Department are also aware of your accomplishments. You may not defend your dissertation unless it is properly announced and the dissertation is available for reading. The Graduate Administrative Assistant may be able to assist you in announcing your defense and scheduling the seminar and conference rooms for the defense. Note also that faculty and peers need early notification to add your defense to their schedules.

Department Notification: At least two weeks prior to defense of your dissertation, you and your adviser are responsible for announcing your departmental seminar and defense of dissertation. Please place these four (4) items in the Biology Office mailbox reserved for dissertations:

\[\begin{align*}
a. & \text{ An announcement of your defense including date, time, and location. This item should be placed in all faculty mailboxes and on Department bulletin boards} \\
b. & \text{Abstract of your dissertation.} \\
c. & \text{Your curriculum vitae.} \\
d. & \text{A complete copy of your dissertation.}
\end{align*}\]

Dissertation Reviewers Report Form: At least 7 days prior to the date of the oral defense, the Dissertation Reviewers Report form must be completed and signed by the thesis committee and submitted to the Graduate School. Using this report form, the student’s committee must certify that the dissertation is “ready for defense.” A majority of the members of the dissertation committee must sign this form, but this does not guarantee that the dissertation is acceptable in its submitted form. This report is necessary to officially announce your defense.

University Notification

At least 7 days prior to your defense, you must announce the defense to the Graduate School by:
a. Listing your defense on the Doctoral Defense Schedule; this link is from the Graduate Dissertation check list page. See Biology Administrative Officer for assistance.

b. Online form (Doctoral Dissertation Reviewers Report) http://grad.georgetown.edu/academics/academic-forms/

12. DEFENSE OF THE DISSERTATION

The defense of the Ph.D. dissertation is an opportunity for the entire University community to examine the candidate. Thus, the defense is a public presentation of the thesis with open questioning to follow. In the Department of Biology, the candidate is also examined in private by the dissertation committee. The public portion of the defense is part of the examination and should not be trivialized. The private defense should take place immediately following the public examination. Exceptions to this must be approved by petition of the committee on graduate students and studies AND the Department chair. In either event, the ballot cannot be signed until after both the public and private portions of the defense.

A Thesis or Dissertation Defense Report form indicating a successful defense of the dissertation will be submitted directly to the University Registrar's Office by the department or program (not the student) before the student can be cleared for graduation.

If the candidate fails the dissertation defense, the graduate program (not the student) will report the failure by submitting the Thesis or Dissertation Defense Report form directly to the Graduate School.

13. SUBMITTAL OF THE FINAL DRAFT OF YOUR DISSERTATION

After the defense, the dissertation will often require revision. It must then be approved by the following:

a. the dissertation committee,

b. the adviser, and

c. the Director of Graduate Studies

It is strongly recommended that you allow, at the VERY LEAST, 2 weeks after your defense to make revisions and corrections as recommended by your Ph.D. Dissertation Committee, and to obtain final signatures approving your dissertation. Signatures from committee members from outside institutions may be obtained at the time of the defense.

After the appropriate forms are signed, call the Graduate School for an appointment. It will examine the dissertation to make sure you have followed all of the directions. YOU MAY NEED TO MAKE MORE CHANGES. After your dissertation is completed, hand-carry it and its cover sheet to the Graduate School.
and obtain a receipt. DO NOT send your dissertation to the Graduate School by regular mail. Dissertations are also submitted electronically and this enhances their accessibility.

### I. SAMPLE SCHEDULE FOR EARNING AN M.S.

This table provides only one possible route for completion of your M.S. there are, however, many ways to reach that goal. The table indicates "benchmarks" a student needs to meet in order to complete the degree in the specified time. **Note – the MS degree requires 24 credits of coursework.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall semester</th>
<th>Spring semester</th>
<th>End of academic year</th>
</tr>
</thead>
</table>
| 1    | – Take BIOL 505, BIOL 999, plus one additional course*  
– Attend departmental seminars  
– Develop plan for M.S. Comprehensive Exam | – Attend laboratory meetings and journal club  
– Take BIOL 506, BIOL 999, plus 1–2 additional courses*  
– Attend work-in-progress seminars (WIPS)  
– Attend departmental seminars | – Select mentor  
– Take M.S. Comprehensive Examination  
– Perform research  
– Form M.S. Dissertation Committee |
| 2    | – Take course work as needed*  
– Take thesis research 999  
– Attend departmental seminars  
– Attend laboratory meetings and journal club  
– Have committee meeting to evaluate progress. | – Submit thesis proposal to Graduate School  
– Complete course credits*  
– Thesis research 999  
– Attend departmental seminars  
– Attend laboratory meetings and journal club  
– Present/Attend WIPS | – Perform research  
– Write thesis  
– Present thesis seminar |

* Including biostatistics taken in either year 1 or year 2.

### I. GENERAL PROCEDURES FOR OBTAINING AN M.S.

**Credit Requirements:**
a. A minimum of 24 graduate course credits
b. A minimum of 2 semesters and 1 summer in residence.
c. At least one TF assignment per semester while a full-time student
d. M.S. Comprehensive Examination
e. M.S. Thesis with defense and seminar

Minimum Time Requirement

The minimum time requirement for obtaining an M.S. degree is two regular semesters plus one summer session.

A total of 24 course credits are required. At least 16 of these credits should be obtained in our Department. No more than 8 credits with numbers below 350 may be taken for graduate credit, and the proper forms must be filled out to obtain graduate credit for undergraduate courses. (Please see the "Registration" section above.) A full-time graduate student is expected to take at least 9 credits of course work each semester during the first year of residence. These are minimum requirements. Additional requirements may be established at the discretion of your M.S. Dissertation Committee, the CGSS, or both.

2. M.S. COMPREHENSIVE EXAMINATION

The purpose of your M.S. Comprehensive Exam is to prepare a specific document and defend it to your M.S. Comprehensive Exam Committee. Your document will be a grant proposal. Your document should be relevant to your research focus, and it should include biological information related to 508. The Department of Biology gives the M.S. Comprehensive Exam in accordance with Graduate School policy. (Please see the Graduate School catalogue information.)

The main steps of your M.S. Comprehensive Exam are: (1) chose members of your M.S. Comprehensive Exam committee; (2) organize meetings with your committee as needed to review your progress; (3) prepare your proposal; (4) present a written copy of your proposal to your committee; and (5) orally defend your proposal. The CGSS recommends that you form your M.S. Comprehensive Exam Committee in October of your first year at GU. You should take your M.S. Comprehensive Exam in May of your first year. More information about proposal writing is above (under Ph.D. Qualifying Exam).

Note: It is your responsibility to organize M.S. Comprehensive Exam Committee meetings. This includes contacting your Committee members to find out when your entire Committee can meet with you at particular meetings.

Your M.S. Comprehensive Exam Committee should comprise 2–3 regular-faculty professors, including
your research advisor (if you have chosen one in your first year).

Your M.S. Comprehensive Exam Committee will decide on the format and style of your proposal, guide your proposal writing, set deadlines with you, and grade your final proposal.

A student can pass his (her) M.S. Comprehensive Exam with distinction, pass, or pass with remediation, or fail. "Pass with remediation" indicates that you have an academic deficiency that your committee believes can be remedied with a specific action, for example, completion of a specific course. Your M.S. Comprehensive Exam Committee specifies that action. Failure indicates a more serious deficiency. If a student fails his (her) M.S. Comprehensive Exam, his (her) M.S. Comprehensive Exam Committee decides what the student should do with regard to the M.S. Comprehensive Exam to remain in our M.S. Program. A second failure of the M.S. Comprehensive Exam will result in a student's dismissal from the Biology M.S. Program.

Your possible request to extend the deadline of your M.S. Comprehensive Exam must be submitted in writing to the CGSS prior to 15 April of the year of the M.S. Comprehensive Exam. The CGSS will allow your extension for only compelling reasons. You must pass your M.S. Comprehensive Exam within 2 years of your entry into our Biology Program or else you may be dismissed from it. The M.S. Comprehensive Exam is taken by all M.S. candidates, including those entering our Department with advanced degrees.

3. M.S. COMMITTEE AND RESEARCH

Your M.S. Dissertation Committee must consist of at least three (3) members, with two (2) members from our Department and one (1) member from outside of our Department. By the end of your first academic year, you should choose a research area and a thesis mentor. After you accomplish this, you and your mentor will select your M.S. Dissertation Committee. As soon as you set up your M.S. Dissertation Committee, or if you change any part of it, please notify the CGSS. Your M.S. Dissertation Committee usually meets 3–4 times. For example, in meeting 1, your M.S. Dissertation Committee is "officially" established and you and your M.S. Dissertation Committee discuss your thesis proposal. In meeting 2, you all assess your progress. In meeting 3, your M.S. Dissertation Committee decides if you have obtained sufficient data to answer your research question(s), test your hypothesis(es), or both. Meeting 4 is your defense of thesis.

Research accomplished by a student as a paid employee (either on or off campus) may not be used for a thesis.

4. THESIS PROPOSAL

All research M.S. students must have a written thesis proposal that is approved by their M.S. Dissertation Committees. The format of your proposal is up to your M.S. Dissertation Committee. Once they approve your proposal, you must submit a copy to the Graduate School. Please, do not forget! This
is your responsibility. Also, give a copy to the Graduate Administrative Assistant in the Biology Office, Nof Al-haj, for your file.

5. PREPARATION OF YOUR M.S. THESIS

Your thesis must be in accordance with the directions in GU's Guidelines for Dissertation and Thesis Writers. One of the Associate Deans in the Graduate School will examine your dissertation (usually page by page) to verify that it conforms to the rules; therefore, it is extremely important that you follow the directions provided by the Graduate School carefully. The Graduate School provides a checklist for submitting your thesis.

6. WRITING YOUR THESIS

Warning: Writing your thesis is very time-consuming. Before you begin to write your thesis, you would be wise to (1) determine with your M.S. Dissertation Committee if you have enough data, (2) determine how to present your data, (3) discuss the format and contents of your thesis with your adviser, (4) review the format regulations of the Graduate School, and (5) consult an excellent manual of scientific writing approved by your adviser. You should allow ample time for writing your thesis, because it will take longer than you expect. It is important to get as much feedback as possible from your adviser as you are writing. Other members of your M.S. Dissertation Committee will chose which drafts they wish to read as you progress. Some may wish to see many drafts in progress; others may wish to see only later drafts that you and your adviser have edited well. You should keep your M.S. Dissertation Committee members well informed of your progress.

7. APPLICATION FOR YOUR M.S. DEGREE

Master's and doctoral degrees are awarded at the end of each month (except June). To be awarded a degree, you must file an Application for Graduate Degree via MyAccess by the first business day of the month in which you intend to defend. (May is an exception, and other deadlines apply.) Instructions are available at http://grad.georgetown.edu/academics/how-to-graduate/.

8. ANNOUNCEMENT OF YOUR DEPARTMENTAL SEMINAR AND THESIS DEFENSE

At least 7 days prior to defense of your thesis, the student and his (her) mentor are responsible for announcing the student's departmental seminar and the defense of thesis. These four (4) items are placed in the Biology Office mailbox reserved for dissertations:

a. An announcement of your defense including date, time, and location. This item should also be placed in all faculty mailboxes and on Department bulletin boards.

c. Your curriculum vitae.

d. A complete copy of your thesis.

University Notification
At least 7 days prior to your defense

a. you and your adviser must announce the defense to the Graduate School by filling out an online form called Thesis Reviewers Report (http://grad.georgetown.edu/academics/academic-forms/). All members of your thesis committee must sign this form indicating your thesis is ready for defense. This does not guarantee that your thesis is acceptable in final form.

b. you must place a complete copy of your thesis in the Biology Office mailbox reserved for dissertations and theses

9. SUBMITTAL OF THE FINAL DRAFT OF YOUR THESIS

After your defense, revise your thesis. It must then be approved by the following:

a. your M.S. Dissertation Committee,

b. your adviser, and

c. your Department Chair

Warning: The CGSS strongly recommends that you allow, at the very least, 2 weeks after your defense to make revisions and corrections as recommended by your committee, and to obtain final signatures approving your dissertation. After the appropriate forms are signed, please call the Graduate School for an appointment. It will examine your thesis to make sure you have followed all of the directions. You may need to make more changes. After your thesis is completed, hand-carry it and its cover sheet to the Graduate School and obtain a receipt. Do not send the thesis to the Graduate School by regular mail.

J. ADDITIONAL INFORMATION FOR M.S. AND PH.D. STUDENTS

Transferring of Graduate Credits to Georgetown University
You may transfer to GU a maximum of 25% of the total number of required credits for your degree from another university. Only graduate courses, taken at another university, that were not used for credit toward an awarded degree, can be transferred. The credits are not automatically transferred or accepted. Therefore, if you wish to have credits from another university transferred to GU, you should do the following: Obtain the guidelines from the Graduate School and write a letter to the CGSS requesting approval to transfer graduate credits. In that letter, you must provide your official transcript,
indicate which credits you wish to transfer, and include a description of the courses taken at the other institution (for example, give the CGSS a course's description in the university's course catalogue) you wish to transfer. The CGSS will consult with your research committee. If your request is approved, the CGSS will send a letter requesting approval for the transfer of credits to the Dean of the Graduate School. You will be notified of the Dean's decision by letter.

**Academic Standing**
You are expected to maintain at least a B (3.00) average. The Graduate School, CGSS, and Department will review your performance at the end of each semester. If your performance is poor, the CGSS may recommend to the Chair that you be dismissed. If the Chair concurs, dismissal will be recommended to the Dean. In an exceptional circumstance, the Chair may independently recommend dismissal. An "F" in two courses will ordinarily result in a dismissal recommendation. Dismissal is usually for academic reasons; however, a dismissal may be recommended to the Dean whenever it appears to be the best interest of the focal student, the Department, or the University, including poor performance as a TF. You must have a 3.00 average to take the M.S. Comprehensive Exam and the Ph.D. Comprehensive Exam. It is your responsibility to verify that you have met this requirement prior to taking these exams.

**Change of Status**
"Change of graduate-student status" means a change from an M.S. status to a Ph.D. status or vice versa; a change from special-student status to graduate-student status; or dismissal from our program. A request for a change may come from you. A recommendation may come from an individual professor, your academic advising committee, M.S. Dissertation Committee, Ph.D. Dissertation Committee, or the CGSS. The CGSS reviews all such recommendations and either approves or disapproves them. The CGSS sends a notification of its action to the Chair who sends approval or disapproval to the Dean. Changes in status may relate to things such as quality of your performance in a formal course, research progress or lack thereof, teaching, or your general attitude. In each case of "change of status" action, the best interests of the student, Department, and University are carefully considered. You have the right to request to appear before the CGSS to discuss a pending action or to appeal a decision to the CGSS, Chair, or Dean.

**Leave-of-absence**
If external events threaten to interfere with normal progress in your graduate program, you may seek a leave-of-absence. You should consult with your adviser and the CGSS in advance, because your absence may have ramifications for fellowship and TF scheduling. The procedures for application for a leave-of-absence are described in the Graduate School online catalog. Your application should be approved by your adviser and the Chair before it goes to the Graduate School.

**Appeals**
If you wish to appeal any academic decision that is made about you, such as a grade in a course or on an exam, you should first discuss the situation with the professor involved. Appeals may be made first to
the Chair and then to the Dean.

**Predoctoral Grants**
Graduate students are encouraged to seek external fellowship support. Writing research proposals helps in the process of developing and articulating research ideas. Further, developing a record of successfully funding your research (the dollar amount is essentially irrelevant) is an important part of your career progress. There are several online services that list available funding opportunities (e.g., see http://www.gradschool.cornell.edu/fellowships/). Please consult your adviser or one of the co-chairs of the CGSS for advice in writing a grant for pre-doctoral support.

**Funds for Scientific Meetings**
The Graduate School provides support for travel to scientific meetings. See application details at: http://grad.georgetown.edu/financial-support/conference-travel-grants

The Department has limited funds to cover travel expenses so that students can present at scientific meetings. Additionally, CGSS requests that students apply to the Graduate school for funding first, and then the department. If the graduate school denies the request for travel funding, it will be up to the discretion of the Biology Department to cover the expenses. Furthermore, departmental travel assistance will not exceed $1,000 total for each graduate student across all years of their graduate education at Georgetown University. If you wish to apply for departmental funds, please discuss the situation with your adviser and then write an email to the Director of CGSS requesting funds. Include:

- the name, location, date and URL of meeting website;
- your abstract and the title and type of presentation (Exceptions are made for educational workshops that will contribute markedly to your professional and/or intellectual development);
- information on previous travel funds received from the department— year and quantity;
- evidence that you applied for a travel grant offered by the association, or the meeting sponsors (e.g. SDB, ASCB, ASM);
- an itemized estimate of the cost of the meeting;
- a brief email from your advisor supporting your request.

If approved, the CGSS will forward the request to the Biology Accounts Analyst.

**Change of Address or Telephone**
Please notify the Department Office and the Registrar's Office (in White-Gravenor) as soon as possible if
you change your address or telephone number. The Registrar's Office mails your grades to you at the end of each semester and informs you if there had been a change in the registration schedule. Foreign students must also notify the Office of International Programs regarding all address changes.

K. GRADUATE STUDENT ORGANIZATIONS

Georgetown University Graduate Student Organization (GSO)

The purpose of the GSO is to promote communication among all graduate students from different departments. The GSO sponsors seminars, socials, and other special events. The biology graduate students elect one representative each year. Please see https://blogs.commons.georgetown.edu/georgetowngso/.

Biology Organization of Graduate Students (BOGS)

BOGS is the organization of graduate students within our Department. Students established BOGS to make program recommendations and to represent their views. BOGS is composed of one elected representative from each class year. Graduate students should address their concerns and problems to the members of BOGS.

Graduate students elect one graduate student representative to GSO meetings and one or two graduate student representatives to CGSS meetings. These alternate annually.

L. GRADUATE STUDENT BILL OF RIGHTS

(Originally Prepared by the Graduate Students and accepted by the Faculty, circa 1990, updated by the CGSS in 2005 and 2006)

1. Student-Mentor Interactions

A. Good communication between a mentor and a student is absolutely critical in order to perform quality science and maximize the educational experience. It is the student's right to expect that the mentor be actively [intellectually] involved in each student's project. The participation of the mentor in the student's project enables the pair to anticipate and resolve problems in a timely fashion.

B. It is critical that a mentor and graduate student schedule frequent meeting times to discuss the student's progress and problems and current literature, and to provide encouragement and support. Although flexibility is essential in order to accommodate individual schedules, students have the right to expect such meetings.

C. The expectations that the mentor has of the student should be made clear from the time when the student joins the mentor's lab. It is realized that expectations may change somewhat
as a research project evolves, and that these changes should be discussed. The student must ask questions concerning the parameters of any potential dissertation projects, comprehensive exam formats typically followed in the mentor's lab, responsibilities as a member of that lab group, career options, etc. It is recognized that the student has the right to initiate discussions pertaining to both the mentor's and the student's expectations of each other and the project, the student's career goals, and how the student's training can prepare for these goals. The student is also responsible for conveying any concerns and changes in personal career goals to his, or her, mentor.

D. The student should exercise his, or her, right to be involved in the development of his, or her, dissertation from start to finish. During the process of choosing a dissertation, a student is encouraged to discuss with his, or her, committee, or with other scientists the degree of risk associated with any dissertation projects that are considered. A time limit should be established in order to provide a reasonable point at which the project can be reevaluated and when other approaches must be considered. In order to avoid delays due to project failure, it is recommended that alternative strategies, or options, be discussed early in a student's project. At a minimum, dissertation progress and expectations must be reviewed annually by the committee.

II. Qualifying and Comprehensive Exams

A. A formal statement as to the purpose of the M.S. Comprehensive Exam and Ph.D. Qualifying Exam is in this Graduate Student Handbook. You should be aware of the format, grading, and of the consequences of exam failure.

B. A formal statement as to the purpose of the Ph.D. Comprehensive exam is in this Graduate Student Handbook. Students are encouraged to ask their mentors about the formats used in their labs and those used in other labs. The student has the right to know the format of the comprehensive exam that is given in the lab that the student has chosen to enter.

III. Student responsibilities and rights as a member of the Georgetown University Department of Biology.

A. Teaching fellowships are recognized as an essential part of our Graduate Program, and it is the responsibility of the student to devote the appropriate amount of time needed for both physical and mental preparations for each lab session. It is recognized that it will take different students different amounts of time to become prepared. In a semester in which a student is serving as a teaching fellow, that student is expected to spend approximately 15 hours per week, including intellectual preparation, over the course of the semester. If a particular TF assignment requires significantly more time than this, it is the responsibility of the student to bring this to the attention of the course instructor, or, if need be, to the CGSS or Chair.

B. It is the student's right and responsibility to ask his, or her, mentor, other faculty members, or both, about the availability of outside grants or scholarships for which he, or she, may apply. To
be awarded such a grant has recognizable financial benefits to the student, lab, and Department, as well as the provision of valuable experience in abstract and proposal writing and field exposure for the student. It is also a helpful addition to a resume.

C. It is the student's right and responsibility to attend and participate in departmental functions such as our Thursday-afternoon seminar series.

**M. BIOLOGY PERSONNEL**

Departmental Chair- Professor Elena Silva

Committee of Graduate Students and Studies
For 2017-2018, the Committee is:
  Professor Ronda Rolfes, Co-Chair
  Professor Gina Wimp, Co-Chair
  Professor Peter Armbruster
  Professor Shweta Bansal
  Professor Dan Isaac (Biology Program Manager)

Biology Office (406 Reiss)
  Administrative Officer: Nof Al-Haj
  Accounts Analysis: Margaret Chung

The Biology Office can give you a current list of personnel and their room numbers, phone numbers, and e-mail addresses.

**N. OUTSIDE JOBS AND FELLOWED GRADUATE STUDENTS**

The Biology Department allows only 4 hours/week of employment outside of your graduate research. While outside jobs can help to "make ends meet", they can also significantly slow students' progress. Failure to maintain adequate progress toward the degree can result in loss of fellowship support. To improve your chance of finishing your research and dissertation on time, it is a requirement to discuss your outside job(s) and work hours with your adviser.

**O. GU GRADUATE BIOLOGY STUDENT OF THE YEAR**

**Requirement:**
1. One-page letter of support from mentor.
2. Student’s CV or Resume

**Optional:**
1. Additional letter of support from faculty member who has worked with or taught with the student.

**Criteria (in rank order of importance):**
Teaching and Service are given primary consideration only if there is no graduate student that shows excellence in scholarship. Status in the program is considered only if there are two equally outstanding candidates and one is more senior than the other. Awards are not necessarily given every year.

Each fall, the Faculty in the Department votes on the Graduate Biology Student of the Year. Graduate students and faculty nominate students for the award. The awardee receives a monetary award at a special autumn awards ceremony.

P. BIOLOGY GRADUATE INFORMATION ONLINE

More information about our Graduate Program is at http://biology.georgetown.edu/graduate/.

Q. GLOSSARY

Here are definitions of selected terms from this Handbook.

Adviser, advisor n. Your research adviser. syn. mentor.

Chair, Biology Chair n. The Chairperson of the Department of Biology, currently Professor Elena Silva

Committees:

Academic Advising Committee n. Your initial graduate committee consisting of the Chair of CGSS, another CGSS member and your advisor that is replaced by your Dissertation Committee in your second year.

Committee of Graduate Students and Studies (CGSS) n. The Biology Committee that is directly concerned with the Biology Graduate Program. The CGSS has co-chairs - Dr. Ronda Rolfes and Dr. Gina Wimp, and other faculty members (Drs. Peter Armbruster, Shweta Bansal and Dan Isaac).

Ph.D. Qualifying Examination Committee n. The committee of 3 regular faculty professors helps you set your Ph.D. Qualifying Exam goals and deadlines, and grades your Ph.D. Qualifying Exam. One member is your advisor.

M.S. Dissertation Committee n. The committee of professors, other scientists, or both that advises your M.S. research and dissertation.

Ph.D. Dissertation Committee n. The committee of 4 professors, other scientists, or both that advises
your Ph.D. research and dissertation.

Dean *n.* The Dean of the Graduate School. The Dean of the Graduate School is Dr. Norberto M. Grzywacz.

Department *n.* Department of Biology. Note: Our official name is Department of Biology, not Biology Department.

**Department of Biology official address:**
Reiss Building Suite 406
Georgetown University
Box 571229
Washington, D.C. 20057-1229

Director(s) of Graduate Studies *n.* The Chair or co-Chairs of the CGSS, currently Professors Ronda Rolfes and Gina Wimp.

Dissertation *n.* A written, formal paper that a student prepares as part of earning a college degree. *syn.* thesis.

Evolution, Ecology, and Behavior (EEB) *n.* An area of biology concerned with ecology, evolution and behavior; experimental approaches include field work as well as genetic and computational modeling.

Graduate-student academic file *n.* A file of your academic records, evaluations, etc. maintained by the Department of Biology.

Mentor, See adviser.

Molecular and Cell Biology (MCB) *n.* This term refers to faculty and students with interests centrally in molecular, cell, and neural biology (including biochemical, genetic, evo-devo, computational, applied health, and related approaches).


**Examinations**

M.S. Comprehensive Exam *n.* The exam that a M.S. graduate student usually takes during his (her) first year which is written document in the form of a grant proposal that relates to the student’s research focus, as explained in more detail below. Your M.S. Comprehensive Exam is the same exam as the Ph.D. Qualifying Exam given in a particular term. Your M.S. Comprehensive Exam Committee grades your Exam at the M.S. level.

Ph.D. Qualifying Exam *n.* The exam that a Ph.D. graduate student usually takes during his (her) first year which is a written document in the form of a grant proposal that is outside of the student’s and mentor’s research focus as explained in more detail below. Your Ph.D. Qualifying Exam Committee assesses your Ph.D. Qualifying Exam.

Ph.D. Comprehensive Examination *n.* An exam that a Ph.D. student takes before the end of his (her)
third year after he (she) passes his (her) Ph.D. Qualifying Exam.

The GU Graduate School of Arts and Sciences Webpages

(http://grad.georgetown.edu/pages/current_students.cfm) contain information related to many of the topics in this Handbook. In some cases the webpages will have information that is more current than this Handbook, and the new Graduate School information should supersede that in this Handbook. Please see, in particular, the graduate school regulations, rules and procedures (http://grad.georgetown.edu/academics/policies/). It is important that all students are aware of Georgetown’s code of conduct and policies regarding academic integrity (see the Graduate School Bulletin at: https://sites.google.com/a/georgetown.edu/gsas-graduate-bulletin/).