

**THE UNIVERSITY OF TENNESSEE / ORNL
GRADUATE PROGRAM OF GENOME SCIENCE &
TECHNOLOGY**



**GENOME SCIENCE
AND TECHNOLOGY**

GRADUATE STUDENT HANDBOOK

**16th Edition
2020**

The University of Tennessee
Graduate Program of Genome Science & Technology
Student Handbook

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Graduate Program of Genome Science & Technology
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WELCOME

Welcome to the Graduate Program of Genome Science and Technology. We are pleased to have you join our Program. Offered jointly by the University of Tennessee and the Oak Ridge National Laboratory, Genome Science and Technology (GST) is a unique, multi-disciplinary program for full time graduate study leading to the Ph.D. or Master's degree.

INTRODUCTION

In order to serve the mission and vision of the Graduate School and preserve the integrity of Graduate Programs at the University of Tennessee, Knoxville, information related to the process of graduate education in each department is to be provided for all graduate students. Based on Best Practices offered by the Council of Graduate Schools, it is important that detailed articulation of the information specific to the graduate degrees offered in each department/program be disseminated.

The primary and authoritative source of information concerning the major degree requirements of the graduate program are published in the *UT Graduate Catalog* ([grad-catalog](#)). This Handbook does not deviate from established graduate school policies as noted in the Graduate Catalog, but rather provides the specific ways in which those policies are carried out. It is important that you read both the catalog and this handbook, because you are responsible for knowing and following these policies. Undue negligence can delay your progress toward graduation. The GST website (<http://gst.tennessee.edu/>) also lists a succinct synopsis of degree requirements.

Graduate students are expected to be aware of and satisfy all regulations governing their work and study at the university. Please refer to the Hilltopics Student Handbook (hilltopics.utk.edu) for detailed information. It is important to remain in good academic standing in order to not compromise progress in the program or financial support (more information at [academic standing](#)).

Overview of the GST program

The GST program provides research training in the rapidly evolving areas of the biological and computational sciences that are informed by genome sequencing efforts. There are five areas of emphasis, including

- Molecular Genetics and Systems Biology
- Computational Molecular Biophysics
- Bioinformatics
- Structural and Nanoscale Biology
- Analytical Technologies for Bioenergy and the Environment

The program takes advantage of the unique opportunities for interaction and collaboration between The University of Tennessee (UT) and the Oak Ridge National Laboratory (ORNL). GST is formally a 'Specialization' in the

intercollegiate Life Sciences graduate program and is housed in the College of Arts and Sciences. Several dozen faculty members at UT and staff scientists at ORNL are associated with the program (<http://gst.tennessee.edu/>). Interdisciplinary research projects that are mentored jointly by scientists from UT and ORNL are particularly encouraged.

The science of genomics was jumpstarted by the Human Genome Project, an effort to determine the complete DNA sequence of the human genome, to identify and functionally characterize the approximately 20,000 human genes, and to develop experimental and computational tools for data analysis. Access to entire genome sequences including those of model and non-model organisms, has revolutionized biology, leading to new discoveries in the health sciences, with rapid advances in drug design, neuroscience, cancer biology, and microbial pathogenesis. New technologies are yielding equally powerful insights into the transcriptome, the proteome, the metabolome, the epigenome and numerous other layers of organismal function. Experimental approaches such as genome editing, imaging and structural biochemistry further elevate these advances to a level where predicting the outcomes of genetic interventions appears ever more feasible. New computational technologies including network analysis and mathematical modeling and simulations allow sophisticated predictions that can either be tested experimentally or yield insights where no experiments are feasible. These advances impinge on all segments of the life sciences including applications in plant breeding and agriculture, evolutionary biology, ecology, anthropology and the social sciences, medical ethics, and many other aspects of contemporary culture.

GST now has a 20-year record of placing successful graduates into competitive positions in academia, government laboratories, and private industry such as the biomedical industry (see <http://gst.tennessee.edu/gst-graduates/>). To this end, the program emphasizes a solid foundation in genetics, molecular and cellular biology, biochemistry, and computing, followed by more specialized training.

GST Personnel

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Standing Committees

The GST program is governed in part by its standing committees, which are composed of GST faculty members. Several of the committees have student representatives.

- Recruitment Committee
- Admissions Committee

- Annual Meeting/Social/Retreat Committee
- First Year Advisory/Student Presentations Committee
- Graduate Affairs Committee
- Comprehensive Examinations Committee
- Curriculum Committee
- Development/Training Grants Committee
- Seminars/Colloquia Committee
- Steering Committee

Graduate Student Organization – contact: Alex Teodor ([Email](#)).

Academic and Research Climate

The University of Tennessee (UT) is the premier state-supported research university in Tennessee. It offers a comprehensive range of programs, both related and unrelated to Genome Science and Technology. Within the life sciences, state-of-the-art research facilities include high-end instrumentation for structural biology, biochemistry, and computational modeling, automated DNA sequencing, and other core facilities, and a microscopy center with confocal, electron and atomic force microscopes.

Oak Ridge National Laboratory (ORNL): A unique strength of the ORNL program is its multidisciplinary nature, with strong institutional programs in computational biology, analytical technologies such as mass spectrometry, structural biology using neutron scattering, nanotechnology, plant and microbial genomics, and microscopic imaging. The Spallation Neutron Source (SNS) is currently the most powerful facility for neutron scattering experiments anywhere in the world, opening unprecedented views into the structure of materials, including biomolecules. ORNL hosts some of the most powerful supercomputers available to scientists anywhere in the world.

ADMISSION REQUIREMENTS AND APPLICATION PROCEDURES

For details on admission requirements and application procedures, please refer to the GST website (<http://gst.tennessee.edu>). The Graduate Catalog (<https://catalog.utk.edu/index.php?catoid=27>) also provides information on the application and admission policies. Admission to UT in general and GST specifically is through the Office of Graduate Admissions (ADMIT web interface).

Mid-semester termination or withdrawal: If a student is terminated or withdraws from a program prior to the end of the semester, the student will be responsible for payment of tuition and other fees from the termination/withdrawal date until the end of the semester. The responsibility for paying tuition and fees will apply to all students, including those who have tuition waivers during the semester in which they are terminated/withdraw early. If you are considering early withdrawal, you should contact the Bursar's office to inquire about the financial ramifications. Please see the graduate catalog for additional information at: <https://onestop.utk.edu/withdraw/>.

FINANCIAL SUPPORT OF GRADUATE STUDENTS

Typically, the GST program supports students for the first year (100%) and second year (50%). During this period, students are expected to serve as graduate teaching assistants (GTA) for three semesters. With the beginning of the third year, the thesis/dissertation advisor is expected to cover the student's annual stipend, tuition, and health insurance in the form of a Graduate Research Assistantship (GRA). Certain fees charged by the university, such as

the ‘Activity Fee’ and ‘Technology Fee’, are the responsibility of the student. The duties of the student under a GRA are set by the dissertation adviser and may or may not overlap with the dissertation research. An annual progress report (for example, a memo from the annual committee meeting) is required for renewal of the assistantship. Students must be in good standing in the program for annual renewal of the assistantship.

A graduate assistantship (GTA or GRA) is considered a half-time appointment (50% time). It is expected that students dedicate their remaining time towards the degree program in the form of research and learning. Therefore, students should not accept any additional salaried appointment either within or outside of the university without prior approval from the GST program director and the dissertation adviser and the Graduate School. Noncompliance with this policy may, among other possible consequences, compromise the graduate assistantship from the program. When applicable, the form "Additional Pay Request for Graduate Students on Assistantships" must be completed and submitted for approval to gradschooldean@utk.edu.

Students are encouraged to seek financial support for their course of study in the form of fellowships awarded by the University of Tennessee ([Graduate Fellowships](#)), or other private, governmental, or international agencies. Financial assistance to attend conferences or workshops is available on a competitive basis from the GST program and the UT Graduate Student Travel Fund, which is administered by the Graduate Student Senate (GSS, <http://gss.utk.edu/travel-awards/>). Typically, costs are split between various sources including the travel budget of the mentor’s research grant.

Teaching Assistantships: Because gathering experience and competence in an instructional role is a key component of graduate training, all Ph.D. students are required to serve as Graduate Teaching Assistants (GTAs) for two semesters during their tenure at UT, and M.S. students serve one semester. Beginning in 2018, GST students have a GTA assignment in Spring of their first year and, depending on the precise mechanism of financial support, in Fall and Spring of their second year. Students usually teach lab or discussion sections in the lower-division Biology (BIO) courses, in BCMB or GST courses. Students are encouraged to express their preference concerning the course they would like to serve in, although there is no guarantee that the request can be honored. Teaching assistants are expected to work effectively and seamlessly with their course instructors. Teaching assignments are preceded by orientation sessions where best practices are taught before the start of the semester and extend until grading is completed. GTAs must be available on campus for the entire time, and absence may compromise the financial assistance. Teaching is evaluated by both supervisors and students on the UT campus. Students also have the opportunity to build their teaching credentials with formal pedagogical courses, certificates from the Tennessee Teaching and Learning Center, and awards.

Students whose native language is not English must pass the OPIc test, which is administered before the start of each semester ([ita-testing-program](#)), before they may serve as a TA with a classroom assignment.

“One should not say ‘I explained the effect’ but ‘I have assigned to it causes whose absurdity no one has as yet been able to demonstrate.’” *Georg Christoph Lichtenberg, 1742-1799*

REGISTRATION AND ADVISING

The University publishes an ‘Academic Calendar’ ([academic calendar](#)) and a ‘Timetable’ of classes ([class-registration](#)) with the schedule for the next semester’s course offerings. There are specific windows of dates to (pre-) register for courses. A newsletter, the ‘*Graduate School News*’, contains a calendar of important dates, deadlines for adding, dropping, or changing credit for courses, thesis examinations, and submission of forms and theses for graduation. For example, formation of your committee, passing of the comprehensive exam, admission to candidacy, application to graduate, and scheduling of the final thesis defense require the submission of specific forms to the UT Graduate School office ([grad_school_forms](#)).

- **Full time status:** GST students are on 12-month appointments and must therefore be enrolled in Fall, Spring, and Summer semesters. The minimal course loads are 6 credits for Fall and Spring (with

GTA/GRA, and typically 9 credits with an external fellowship) and 3 credits in Summer. From the 2017-18 Graduate Catalog: “The maximum load for a graduate student is 15 hours and 9 to 12 hours are considered a full load. For the summer term, graduate students may register for a maximum of 12 hours in an entire summer term (...). Students holding a one-half time assistantship” (as is typically the case for GST students) “normally should enroll for 6-11 hours. (...)”. For international students, “for graduate students who work exactly twenty hours per week or maintain a 50 percent time-appointment assistantship, completion of 6 credit hours per semester is sufficient for immigration purposes ([immigration-information_f1-student](#))”. In the very last semester to graduation, three credits of LFSC600 are sufficient to maintain F-1 visa status.

- Registration for courses should be approved by the adviser or the GST director (for first year students).
- It is important that students sign up for courses in a timely manner each semester. Students who sign up for classes late become personally liable for the tuition. Likewise, back-registrations for a prior semester need to be avoided. Any changes to the credit hours should be completed within about four weeks of the start of each semester (deadlines). Additions to credit hours prior to the deadline for 'drop without W' are fine.
- As a rule of thumb, students on a Graduate Assistantship (not an external fellowship) should be signed up for at least 6 credits each Spring and Fall and 3 credits in Summer. Take note of the “LFSC600 rule”.
- Students focusing on their dissertation or thesis research maintain full-time status by enrolling in LFSC500 or LFSC600, respectively, under the direction of their advisor. Typically, students register for at least 1 credit per semester of LFSC500 (thesis) prior to passing the comprehensive exam, and for at least 3 credits per semester of LFSC600 afterwards. Once a student starts to sign up for LFSC600, (s)he must register for at least 3 credits of LFSC600 every semester, including summer, until graduation.
- Students select a graduate adviser over the course of the first year, usually through the “rotation” process, by the end of the second semester (see Page 9 for details).

This handbook does not give advice on benefits, tax, or immigration/visa questions. Please consult materials received during Orientation for questions of this nature. However, some relevant information follows, from the Payroll Office (<http://payroll.tennessee.edu/paymanual/taxes.htm>), “Graduate students who receive an assistantship and are enrolled in at least 3 hours will be exempt from Social Security/Medicare taxes”, and from Student Health Services (<http://studenthealth.utk.edu/>) “The Student Health Center provides non-emergency outpatient medical care... to students with fewer than 9 hours who have paid the health portion of the programs and services fee” (you have to be registered for a minimum of 3 hours).

DEGREE REQUIREMENTS

What to expect - The first year

Upon arrival, the GST director reviews the student’s background and goals, and together they set a program for the first year. Apart from the core curriculum (see below), students participate in three laboratory rotations, two during the Fall and one during the entire Spring semester. A series of weekly seminars provides an opportunity for students and faculty to become acquainted and to discuss research interests in order to make an informed choice of labs for rotations and, eventually, a home laboratory. Lab rotations provide hands-on experience in a variety of the focus areas of GST as well as orientation about future mentors and collaborators on thesis projects. The core course curriculum includes an introductory programming course, as well as course sequence in Genetics and Genomics, and advanced biochemistry and molecular biology. Starting in 2019, most students completed their first teaching assignment in the Spring of Year 1.

Access to the ORNL campus requires a security clearance, which is required before beginning a rotation at ORNL. Labs at UT are available for rotations immediately.

Keep in mind that in this graduate program success is measured only in part in terms of the grades you receive. More important are the quality and impact of your original research, the opportunity to present at scientific conferences, and recognition in the form of peer-reviewed publications and awards.

"Don't you worry! When you grow up there will be plenty left for you to discover." *Francis Crick's mother.*

Progression through the Program

Year 2: Prior to the start of the first semester of the 2nd year, students need to have identified an adviser/major professor. Careful thought should be given to this important step, and academic, personal, and financial constraints need to be considered. The adviser directs the research and helps to choose courses beyond the *Core Curriculum*. During the second year, and as the research takes shape, students form a *Thesis/Dissertation Committee*, consisting of at least 4 (PhD) or 3 (MS) faculty members including the adviser. The committee's main responsibility is to guide the candidate through the research, but it may also recommend a transition between M.S. and Ph.D. tracks. It helps to design the remainder of the course curriculum, approves your thesis/dissertation and administers the final thesis defense. Apart from additional courses and research activities, you will also be given a *Teaching Assignment*, usually during the 2nd year.

The Director of Graduate Studies of GST will ascertain whether you have passed various milestones. A preformatted checklist should make it easy to keep track (see Appendix). These milestones include:

- Choice of 1st year *rotation* labs
- Choice of your home laboratory and major professor after the second semester (usually May)
- Formation of your *thesis/dissertation committee* in the first semester of the 2nd year
- Completion of *committee meetings*, which are to be held at least once a year
- The result of the *comprehensive examination* (3rd year)
- Changes in the track (Ph.D. versus M.S.)
- Scheduling and outcome of the final *thesis defense*

Year 3 and onwards: The *comprehensive exam* (Ph.D.) is taken during the first semester of the 3rd year. Once passed and if all major coursework has been completed, students should apply for *Admission to Candidacy*. Five years is a reasonable time frame for completing the PhD. In years 3-5 students concentrate increasingly on their research projects, while expanding their horizon with additional formal courses. There is no foreign language requirement in the GST doctoral program. The UT Graduate Catalog mandates that the PhD must be completed by the end of the 8th year at the latest.

Dissertation/Thesis Committees: Graduate School rules state that a PhD committee must have at least four members and MS committees have three (tiny.utk.edu/committee-guidelines). The chair must be UT tenured, tenure-track or UT-ORNL Joint Faculty. For PhD, a second member must be UT tenured or tenure-track faculty. At least one member must sign with a non-GST home department. Scientists external to UT-ORNL may seek approval to serve on committees but must submit a CV when the committee is formed. The GST Director has license to approve or disapprove a proposed committee. GST-specific guidelines are that only one person can chair a committee (no equal co-chairing), and Joint Faculty who have no GST affiliation must also submit a CV.

Probation: Students whose most recent set of 9 credits graded A-F has a grade point average below 3.0 will be placed 'on probation' and need to deliver a GPA > 3.0 in the following semester in order to regain good academic standing and continue in the program. A second semester of GPA < 3.0 results in dismissal from the program and from the UT Graduate School. GST students must also earn a P (Progress) in their thesis/dissertation research (LFSC500/600) each semester they are enrolled, which is typically every semester, including summer, after the first Fall and Spring semesters. Students who receive an NP are not in good standing; a second NP will result in dismissal from the program.

Grades of Incomplete: Occasionally, upon request of the student and after negotiation with the instructor of record, a student may be assigned a grade of 'Incomplete' for a course. Incompletes are given if extenuating circumstances outside the student's control did not allow the student to complete the course. They are not given to allow for extra credit assignment when a student is disappointed with the expected grade. Once assigned, the incomplete must be cleared within the following 12 months. If not cleared, the incomplete will automatically convert to an F (Fail). Clearing the 'I' can occur outside of a regular course or can be done by participating in the missing segment of the course over the following year. However, the student should not reenroll in the course for a second time.

Leave of absence: Students may apply to interrupt their course of studies for one or more semesters up to two years by applying for a leave of absence, which needs to be approved by the GST director and by the Graduate School. For more details, please refer to <http://tiny.utk.edu/dgs-loa> .

Continuous Enrollment: If students fail to register for a semester without filing a request for LOA, they lose their active status and must apply for readmission to continue their program. Students are then responsible for retroactive enrollment fees for the semester in which they were not registered. **Exemption:** Students who have started taking LFSC600 and wish to do an internship that is relevant to their degree can petition to be exempted from continuous enrollment for a maximum of 3 semesters. More details at <http://tiny.utk.edu/dgs-loa>

Advice on deadlines: Deadlines for prelim exams, course exams, committee reports, and dissertations are firm and should be adhered to meticulously. It is considered unprofessional or even disrespectful to miss such deadlines.

“I would like to claim that I reasoned abstractly that such (*wee* yeast cell cycle) mutants would be useful and then tried to find them, but in reality I noticed them only by accident whilst searching for completely different mutants.” *Paul Nurse*

The Master’s Program

The Master’s program includes the following formal requirements.

- Satisfactory completion of 2 lab rotations with two of the five areas of emphasis being covered (see *Overview and Rotation Policy*).
- Formation of a *Thesis/Dissertation Committee* in the first semester of the 2nd year, and at least yearly *Committee meetings*.
- Completion of a minimum of 30 hours of graduate course work beyond the baccalaureate degree, of which a minimum of 6 hours must be in LFSC500 (thesis).
-> Enrollment in LFSC541 (Colloquium) every Spring, beginning with the 2nd semester.
-> Starting in Year 2, one journal club each semester is expected; one of these should be in Scientific Ethics (Responsible conduct of research, e.g. LFSC516).
- Service as teaching assistant for one semester.
- Submission and defense of a Master’s thesis reporting the student’s original research.
- A target for completion of the MS degree is three and a half years.

A non-thesis Master’s option is not offered.

The Doctoral Program

The PhD program includes the following formal requirements.

- Satisfactory completion of 3 lab rotations (see *Overview* and *Rotation Policy*).
- Formation of a *Thesis/Dissertation Committee* in the first semester of the 2nd year, and at least yearly *Committee Meetings*.
- Completion of a minimum of 48 hours of graduate course work beyond the baccalaureate degree, of which a minimum of 30 hours must be graded A-F and a minimum of 6 hours must be graded (A-F) 600 level courses.*
 - > To fulfill these requirements, students ought to
 - a) Complete the *Core Curriculum*
 - b) Sign up for LFSC541 (Colloquium) every Spring beginning with the 2nd semester
 - c) Participate in one Journal Club each Fall and Spring semester beginning in the 2nd year
 - d) Complete 6 graded credits at the 600 level.
 - e) Participate in LFSC516 (Scientific Ethics) once (counts as Journal Club)
- Service as teaching assistant for two semesters.
- A passing performance on the *Comprehensive Examination*, normally in the first semester of the 3rd year. This entails a written research proposal in the student's major field and its oral defense, both of which must be satisfactory.
- Satisfactory completion of a minimum of 24 credits of LFSC600 (Doctoral Research and Dissertation). Doctoral students who have begun registration for LFSC600 must register for it in Summer. Minimum registration for LFSC600 is three credits.
- While not an absolute requirement, it is expected that the Ph.D. candidate has published aspects of the dissertation research as the primary author in the peer-reviewed literature.
- Submission and defense of a Ph.D. dissertation reporting a significant piece of novel and original research.

* Note that LFSC500 and LFSC502 do not count towards the 48 hours. Students who bring an MS degree to the program only need to complete 24 hours of graduate coursework (not counting LFSC600), of which a minimum of 12 credits must be graded A-F, including 6 hours at the 600 level. The MS level courses to be counted towards the PhD must first be approved by the GST director at the time of filing the admission to candidacy.

Rotations

Students complete three lab rotations during the first year (two in Fall and one semester-long rotation in Spring), with the following purpose; (i) allowing prospective students and mentors to match up; (ii) orientation and training in diverse experimental approaches. Students sign up for 2 credit hours in LFSC505 in each of Fall and Spring in the first year. It is expected that students work 10-20 hours per week in their host laboratory. Students are encouraged to contact potential rotation advisers ahead of time, keeping in mind that rotations at ORNL require lead time for security clearance and transportation arrangements. The GST Director works with each student during the first semester to plan the rotations. At the end of each rotation period, the student gives an oral presentation and/or poster to the faculty and other students of the program.

“Why change if you have perfect?” *Rafael Nadal, Tennis player*

Core Curriculum

The GST Program is covers five areas of emphasis, which are broadly described as: a) Molecular Genetics and Systems Biology, b) Computational Molecular Biophysics, c) Bioinformatics, d) Structural and Nanoscale Biology, and e) Analytical Technologies for Bioenergy and the Environment. The general core curriculum below is recommended for all areas, although acceptable alternatives for each area of emphasis are also described below.

The following recommended set of courses should be taken for credit in both M.S. and Ph.D. tracks.

Year 1, Fall LFSC 520 GST I - Advanced Genetics/Genomics (4 hr)

	BCMB 511	Advanced Protein Chemistry and Cell Biology (3 hr)
	LFSC 507	Bioinformatics and Computational Biology I (3 hr)
	LFSC 515	Introduction to GST I (Faculty Presentations; 1 hr, not graded)
	LFSC 505	Research Rotation (2 hr).
Year 1, Spring	BCMB 512	Advanced Molecular Biology (3 hr)
	LFSC 541	Colloquium (1 hr, not graded)
	LFSC 505	Research Rotation (2 hr)
Year 1, Summer	LFSC 500	Thesis (1 hr)
	LFSC 505	Research Participation (2 hr)

Apart from the rotations, not all of the core courses have to be completed during the first year, although LFSC 520, BCMB 511 and BCMB 512 are strongly recommended.

In some circumstances, students may want to choose alternatives that substitute other courses for the core curriculum in the first year. The reasons for such changes to the core curriculum include demonstrated mastery of the course material, a need to first gain appropriate background for the courses, or a desire to specialize more narrowly in one of the emphasis areas listed above. Students who adopt an alternative core curriculum must meet the following requirements: The base courses required for all students are LFSC505, LFSC515, LFSC520, and LFSC541. In addition, at least one course from the series BCMB511/BCMB512 should be taken by all students. Core courses for Computational Molecular Biophysics are: at least two out of the three following courses, BCMB511 combined with BCMB510, BCMB560, and LFSC596. In all cases, the course selection for first year students must be approved by the First Year Advising Committee or the Director.

“Chance favors the prepared mind.” *Louis Pasteur*

"What's my data is mine and what's your data is also mine." *Sydney Brenner on data mining*

Additional Courses

In addition to the core curriculum listed above, Ph.D. students in GST take additional courses to fulfill the requirements listed above. A total of 30 hours must be graded A-F, and of these 6 or more must be graded at the 600-level. In the second year, students should complete at least two 3-credit courses to continue to build the foundation in their area of specialization. These courses can be from within or outside of GST. Examples:

a. GST courses

- LFSC 517 Bioinformatics and Computational Biology (3 hr)
- LFSC 540/541 Colloquium (1 hr, required each Spring)
- LFSC 595/596 Special Topics in GST (1-3 hr, may be repeated)
- LFSC 695/696 Advanced Topics in GST (1-3 hr, may be repeated)
- LFSC 615 Ethics in Research (1 hr, not graded)

b. Graduate courses from other departments, which should be approved by the student's Dissertation Committee (see *Appendix 1* for suggestions). Popular courses to prepare for the Comprehensive Exam are BCMB530 (Spring) and Micro594 (Fall course).

Note: GST students have the option of pursuing a Minor in Statistics alongside their GST track (MS or PhD (see <http://www.bus.utk.edu/stat/igsp/>). The chairperson of the IGMS and MS in Statistics is Mary G Leitnaker, Haslam College of Business). A second option worth considering is the Interdisciplinary Graduate Minor in Computational Science (<http://igmcs.utk.edu/>). The IGMCS requires 15 hours of approved coursework, 6 in GST, and at least 3 in Math and at least 3 in Computer Science. With all concurrent Minor, Masters, or Certificate programs, students must seek approval from their adviser before embarking.

The Science Communication program in the School of Journalism and Electronic Media also offers a concurrent MS. It is directed by Dr. Mark Littman. <http://jem.cci.utk.edu/sciencecommunication>

A PRIMER TO PRODUCTIVE COMMITTEE MEETINGS

Every student should form his/her Thesis/Dissertation Committee during the Fall semester of their 2nd year, i.e. as soon as possible after settling into a home laboratory. Your committee encourages you to conduct your research in a broader context and to practice communication with scientists other than your lab members. The committee members will get to know you well enough to provide meaningful letters of recommendation. And they will eventually approve your thesis. Progression through the program is primarily your responsibility. You are required to schedule and hold meetings with your Thesis/Dissertation Committee at least once a year, starting in the second year. The experience of a first committee meeting is good preparation for the Comprehensive Exam. If you do not form a committee within the expected time frame you are not in good standing in the program and may lose your financial support.

First, form your committee. Using your own and your major professor's judgment identify 3-4 (M.S.) or 4-5 (Ph.D.) faculty-level scientists who are likely to give meaningful guidance on your research. Ascertain that your intended committee meets Graduate School requirements, including the minimal number of UT-resident faculty. Your major professor chairs your committee. Note that some scientists at ORNL are 'Joint Faculty' at UT, and others are not. ORNL Joint Faculty have the privilege to chair a committee. As of 2020, faculty on GST are no longer 'Adjunct' in GST but new appointees receive the 'Joint Faculty' title. Approach each potential member personally to introduce yourself and request that (s)he serve on your Ph.D./M.S. committee.

Second, schedule the first committee meeting a month ahead of time by asking each member when (s)he is or is not available. Book a room (2hrs) and make arrangements for visual aids. Appendix 3 contains a list to help you prepare for your meeting. Briefly, the meeting should give insight and directions regarding the following questions:

- a) Are you in charge of your research project and are you making progress?
 - Prepare a slide-presentation about your research and discuss it with your adviser 2 weeks ahead of time.
 - Write a report (2-5 pages) for your committee and hand it to each member 1 week ahead of the meeting. Note: The Writing Center offers advice on technical writing to international graduate students. <https://writingcenter.utk.edu/>
- b) Are you making progress in your coursework? – Bring a table of courses taken. The committee will want to hear about your interests and will also recommend courses.

Outline of the research presentation (30 minutes, usually interrupted by much discussion):

- Give a broad introduction concerning the general significance of your research project ('big picture').
- Introduce your specific aims.
- Describe your experimental strategy. What is your hypothesis? What are your experiment(s)?
- Present the data including controls and statistics. Did the results confirm or contradict your hypothesis?
- Discuss the next steps.

- Present an outline of medium-term (1-2 years) goals.

Your Dissertation Committee must be approved by the UT Graduate School. Obtain the required Doctoral Committee Form ([grad_school_forms](#)) and bring it to your first committee meeting for signature. The GST Director must sign it as well. It is the responsibility of the committee to give you feedback on your progress in the form of an annual written evaluation. Your committee may ask you to step out of the room before or after the meeting in order to discuss your progress in private. This is normal. It is a good idea to visit each committee member a day or so after your meeting, and exchange feedback. Remember to inform the Director of your committee meeting. Please note that your adviser/committee is expected to provide an annual evaluation, which is best accomplished with the briefing from the annual committee meeting.

A word about the ‘atmosphere’. In academia, scientific progress is evaluated by peer review. Scientists treat each other respectfully - most of the time. However, peer review means that your manuscripts, your funding, and thus your entire career are either propelled forward or derailed by your own colleagues. Your committee is supposed to prepare you for this. Expect to be treated collegially and with respect; but also expect to be asked critical questions. One rule of thumb: Do not let your adviser answer questions from other committee members.

“GET THE DATA!” *Screensaver - Jim Carrington, Oregon State University*

THE COMPREHENSIVE EXAMINATION

The comprehensive exam (Ph.D. only) serves the purpose of evaluating whether the student has the potential to conduct independent research. It is a major milestone in the program and dedicated, conscientious, preparation is required to pass. The comprehensive exam, also known as ‘the prelim’, takes the form of a written **research proposal** and its **oral defense** in the student’s major discipline. It is administered by a committee of five GST faculty members that is assembled by the Chair of the GST Comprehensive Exam Committee. The exam takes place during the Fall semester of the 3rd year. A detailed description is found in Appendix 3. The exam is graded on a pass/no-pass basis. One additional attempt at passing the comprehensive exam is permitted. Students who fail the comprehensive examination twice will not be admitted to Ph.D. candidacy. In this case, the student’s Dissertation Committee and/or the Comprehensive Exam Committee may, or may not, recommend to the student to complete the M.S. track. Each year the Director or the chair of the Comprehensive Exam Committee will discuss the comprehensive exam policies and guidelines with the students and faculty involved with the exams.

Prelim advice: It is important to be very comfortable with discussing scientific research critically and be able to digest critique without getting flustered. Practice makes perfect! The best preparation are committee meetings and completing a grant-writing course. Lab meetings and one-on-one talks with your adviser, a mock defense with fellow students, and journal clubs are also useful.

ADMISSION TO CANDIDACY

Once several major degree requirements have been met, the student may apply for Admission to Candidacy (<http://gradschool.utk.edu/forms-central/>). For Ph.D. students, passing the comprehensive examination is usually the threshold. Additional details, some pertaining to M.S. students, are found in the Graduate Catalog. For example, you must have completed all essential coursework and achieved a GPA of at least 3.0 (B). Enter the courses taken and grades received into the form, also the courses you plan to take in order to satisfy graduation requirements. Next, you obtain the necessary signatures and turn in the appropriate number of copies to the Office of Graduate Admissions and Records. The Graduate School checks to make sure all requirements are satisfied and returns a copy to you. The application must be approved by the Office of the Registrar no later than one full semester prior to the

date the degree is to be conferred (Ph.D.); for M.S. students, the deadline is the last day of classes of the penultimate semester. The office will have indicated the date by which you must finish all your requirements.

“If you try and take a cat apart to see how it works, the first thing you find yourself with is a non-working cat.”

Douglas Adams

ANNUAL EVALUATION

Every graduate student should receive an annual written evaluation, with a copy delivered to the student and a copy, signed by the advisor and student, that is maintained in department files. The evaluation will cover the most recent 12 month period in light of the entire history of the student in the GST program. The evaluation will cover strengths as well as areas for improvements in research and coursework, and may also touch upon teaching and service activities. The evaluation should be completed prior to July 31. Typically, the annual evaluation will be written by the advisor after the annual thesis/dissertation committee meeting with input from the rest of the committee.

The written evaluation assumes particular significance if the performance of the student does not meet expectations. In this case clear statements as to what is expected and consequences of continuing to lag behind expectations will be part of the evaluation. If performance remains unacceptable even after allowing reasonable time for remediation, a recommendation to dismiss the student from the program may be made to the Graduate School and financial support will very likely be suspended.

The written evaluation should be discussed in a face-to-face meeting between the graduate student and his/her advisor. The letter should conclude with signature lines for the advisor and for the student, indicating the date when this meeting occurred. The student’s signature does not indicate agreement with each point of feedback. Instead the student signature appears over a statement similar to this: “My signature indicates I have read this evaluation, I have been given an opportunity to ask questions, and I understand the feedback I have received.”

In the unlikely event of seriously inappropriate conduct, a prompt recommendation for dismissal may be made without opportunity for remediation. Such conditions are described in the policy statements listed in the UT Hilltopics Student Handbook at hilltopics.utk.edu.

DISSERTATION REQUIREMENTS AND THESIS DEFENSE

The dissertation is the permanent record of the novel results and conclusions of the thesis project. The author explains in detail how the work was conducted, to the extent that a person skilled in the discipline can repeat the work. The candidate normally submits the first draft of the dissertation to the major professor. When the dissertation is acceptable to the major professor, it is presented to the other committee members. The committee shall have at least two weeks to read the document in preparation for the thesis defense.

The thesis defense consists of an oral summation of the work, presented in public to all interested parties, including other graduate students, followed by an examination conducted with the student’s committee in private. The committee decides whether the candidate has passed the examination or not. The dissertation approval sheets are signed by the committee when the thesis is acceptable in final form, proofread, and corrected. Students are encouraged to participate in a dissertation workshop, which is announced each term in the internet newsletter *The Graduate School News* before drafting their thesis because the format of the thesis must follow strict Graduate School guidelines (<http://gradschool.utk.edu/thesesdissertations/>). Consultants are available to advise on mechanical details such as margins, page numbering, etc. Theses must be checked to eliminate the appearance of plagiarism before submission (<https://research.utk.edu/ithenticate/>).

Important deadline dates are published each semester in *The Graduate School News*: application for graduation (fee); scheduling the defense; the actual dissertation defense; final submission of the dissertation to the Office of Graduate Admissions and Records. In preparation for graduation, the student is expected to hold a final committee meeting to obtain approval for graduation in an upcoming semester. The student then applies for graduation before the end of the prior semester (note Graduate School deadline) and schedules the defense in line with the Graduate School deadline. The student prepares the dissertation and with assistance and approval of the adviser submits the work to the committee two weeks ahead of the defense. It is the responsibility of the student to advertise the defense, which should be held in a publicly accessible site (typically UT campus). When a student's defense is delayed past the cutoff date for the semester, students may defend by a second deadline; in that case the official graduation date will be the following semester but the student is not charged tuition and need not be enrolled at UT.

Checkout at the end of your program: The GST program requires a 2-3 page CV/RESUME before graduation with the PhD or MS. A formatted template is available from the GST office. UT requires a check-out process ([Final Paycheck Form](#)) before it will release the final paycheck. Of note, it has happened that students who leave UT before the end of their final semester (for a new job) became personally responsible for the tuition/fees of that final semester. If your program ends in mid-semester please advise the GST office ahead of time.

It is in your best interest to publish your research in the peer-reviewed literature, preferentially before or concomitant with graduation. Under certain conditions, it is acceptable to incorporate the text of a finished manuscript as a chapter of the thesis. This may include the introduction, if a corresponding review article has been published. One condition is that you collected the data for the majority of the figures in the manuscript and you must be the primary (usually the first) author. In addition, data and/or text sections contributed by other coauthors on the manuscript must be acknowledged as such in the thesis. The thesis is not copyright-protected, hence duplicate use of the same text is permissible. However, the thesis abstract, typically the introduction, and a final synopsis encompassing a discussion or conclusion, should always be formulated de novo.

“I have yet to see any problem, however complicated, which, when looked at in the right way, did not become still more complicated.” *Paul Anderson, 1969*

ACADEMIC HONESTY AND PLAGIARISM

As a graduate student, it is expected that you are familiar with principles of academic honesty and how to avoid plagiarism. The University of Tennessee has issued an Honor Statement and a definition of what constitutes plagiarism (<http://hilltopics.utk.edu/student-code-of-conduct/>).

Plagiarism: In the sciences, plagiarism arises when inappropriately long passages of written text are cited or used without attribution. As a rule of thumb, any phrase of more than seven words that is copied verbatim from another source needs to be included in quotation marks (“ ”) and a reference needs to be given. This stylistic element is used if at all very sparingly in scientific parlance. The university honor statement states that even using others' ideas without attribution can constitute plagiarism. Moreover, the definition of plagiarism is a lot stricter in the US than in some other countries. If in doubt, discuss the issue and err on the safe side.

Academic honesty: You are expected to complete assignments by yourself, unless teamwork is specifically approved by the instructor. You may use any source of information, unless specifically or implicitly (closed-book exam) excluded by the instructor. However, plagiarism is never acceptable.

Dishonesty and plagiarism are serious offenses. Penalties may include failure of the course or dismissal from the program and the university. ‘I didn’t know’ is not a valid excuse, so, if you are at all uncertain about what is acceptable, be sure to ask. The University Libraries offers several resources to graduate students to avoid and detect plagiarism ([libguides plagiarism](#)) and to help with publication questions ([libguides publishing](#)).

GRIEVANCES AND APPEALS

Even though students, staff, and faculty in the program usually try their best to solve problems in a constructive and effective manner, there are occasions when a little extra help is needed. It is often most effective to confront the person with who you are having a conflict directly, even if the person happens to be your adviser. If the issue cannot be resolved to your satisfaction, you may request a meeting with the Director and any other personnel involved in a dispute. The initial appeal must be filed no later than 30 days after the incident that occasions the appeal. At this point, the Graduate Affairs Committee may function in an advisory role to the Director.

If the departmental procedure does not lead to resolution of the complaint, the next level is an appeal at the College level. This appeal must be filed within 30 days of a final decision at the department level. If no satisfactory resolution can be achieved the Graduate School policy is stated here:
<http://gradschool.utk.edu/documents/2016/02/student-appeals-procedures.pdf>

Note that this policy applies only after grievances have been duly processed, without resolution, through appropriate appeals procedures at the department and college levels.

Appendix 1 - Courses for GST students

A. Life Sciences – Genome Science and Technology

If not listed otherwise, courses are graded A-F. P/NP courses are graded 'pass/no-pass'. S/NC courses are graded as 'satisfactory / no credit'. Prereq: Prerequisite. Only classroom courses with regular meeting times are listed. The full UT Course Catalog may be downloaded at <https://catalog.utk.edu/index.php?catoid=27> or <http://diglib.lib.utk.edu/dlc/catalog/>. See the UT Timetable of Classes to determine whether a class is offered in a given semester.

507 Bioinformatics and Computational Biology I (1-3) Programming for statistical and graphical analysis of biological data. Introduction to computer programming for students with little or no prior programming experience. Lecture and lab (Python).

515 Introduction to Genome Science and Technology I (1) Introduction to research projects of individual GST faculty members (S/NC).

517 Bioinformatics and Computational Biology II (1-3) Comparative genomics and bioinformatic analysis of protein and DNA sequences (Spring). (Karen Lloyd, no longer taught as LFSC517).

520 Genome Science and Technology I (4) Core course on genomics and advanced genetics principles using bacterial, plant, biomedical, and population-genetic model systems. Lecture and discussion.

521 Genome Science and Technology II (4) Analytical technologies including but not limited to proteomics, X-ray crystallography, nuclear magnetic resonance, atomic force microscopy, next-generation sequencing, and other topics. Lecture. This course was dropped from the GST core curriculum in 2019 and no longer offered.

541 Spring Colloquium (1) Presentations by GST graduate students. Required every spring (S/NC).

595-596 Special Topics in Genome Science and Technology (1-3) Tutorials or lectures in a variety of special topics to be chosen by instructor. Previous topics included Advanced Microscopy in Biological Sciences (3), Bioinformatics and Computational Biology III (2), Mini-courses on Systems Biology, Python Programming and Plant Genetics (1).

595 Survey of Biology for Computational Researchers (3). This course is directed at students who are interested in computational biology but lack a formal undergraduate training in biology. It covers genomics and bioinformatics, biochemistry and biophysics, cell biology and cellular signaling, immunology and cell communication, phylogenetics and evolution, and population ecology. Spring.

615 Scientific Integrity and Ethics (1). Cotaught as BCMB614.

615 Journal Club in Genome Science and Technology (1) Reading and discussion based on current literature. May be repeated. Maximum 12 hours. S/NC. Examples: 001 Mass Spectrometry (Hettich), 002 Genetics (Voy), 003 Biophysics (Smith), 004 Microbial Systems (Graham and Podar), 005 Computational Biology (Hauser and Pan).

695-696 Advanced Topics in Genome Science and Technology (1-3) Tutorials or lectures on any advanced topic to be chosen by instructor. May be repeated. Examples: 001 Biophysics (Smith), 002 Statistical Genomics (3 cr, biannual, Saxton, Animal Science AS675), 003 Mass Spectrometry (3 cr, biannual, Hettich and others), 004 OMICS (3 cr, Pan), Next-Gen Sequence Analysis (3 cr, Staton), Computational Biology (1 cr, Langston), MD simulation of proteins (3 cr, Johnson).

592 Off-campus study. This course number is used to provide for continuous enrollment for students on internships. Graded A-F.

595-596 Special Topics in Genome Science and Technology (1-3) Tutorials or lectures in a variety of special topics to be chosen by instructor. Previous topics included Advanced Microscopy in Biological Sciences (3), Bioinformatics and Computational Biology III (2).

B. Suitable courses offered by other departments (not intended to be complete)

Biochemistry, Cellular and Molecular Biology (BCMB)

510 Computational Structural Biochemistry (1) Computer lab teaching structural biology software. Corequisite BCMB 511 (Fall).

511 Advanced Protein Chemistry and Cellular Biology (3) Cellular structure and function at molecular and supramolecular level in progression: protein structure and function; membrane structure and function; bioenergetics and membrane proteins. Prereq: Prior knowledge of cell biology and biochemistry and/or consent of instructor. Part of GST core curriculum. (Fall).

512 Advanced Molecular Biology (3) Regulation of nucleic acid expression and protein activity. Nucleic acid structure and function; replication and repair of nucleic acids; gene expression; protein synthesis; post-translational protein modification; mitosis and meiosis; cell cycle and cell growth. Part of GST core curriculum. (Spring).

515 Experimental Techniques (3). Lecture-format. Introduction to wet-lab techniques in molecular cell biology, genetics, biochemistry and bioinformatics. (Fall).

518 Biophysical Chemistry (4). Advanced topics course. Specific topic area varies with instructor.

530 Experimental Design and Analysis (3). Informally known as 'The Grant Writing Course'. Grantsmanship, scientific writing, and peer review. This course is recommended for second year students in preparation for the comprehensive examination ('prelim'). (Spring).

560/610 Advanced Concepts in Structural Biology/Biochemistry (3) Concepts related to structural biology/biochemistry with information taken from current literature. Predominantly lecture format with student participation. Specific subject area rotates between X-ray crystallography, and other structural techniques. Permission of instructor. May be repeated.

562 Introduction to Electron Microscopy (3) Practical application to techniques for preparation of biological samples for viewing in transmission electron microscopy. Use of microscope and ancillary equipment, darkroom techniques, preparation of materials for publication and special project. Admission limited only to departmentally approved graduate students. (Spring).

570 Advanced Concepts in Cellular/Molecular Biology (3) Concepts related to cellular/ molecular biology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Permission of instructor. May be repeated.

610 (003) Advanced Concepts in Genetics/Developmental Biology (3) Concepts related to genetics/ developmental biology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Permission of instructor. May be repeated.

606 Journal Club in Structural Biology and Biochemistry (1). S/NC. May be repeated.

608 Journal Club in Genetics and Developmental Biology (1). S/NC. May be repeated.

615 Special Topics in Biochemistry, Cellular, and Molecular Biology (3) Biochemical and biophysical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry, molecular genetics, cell ultrastructure and physiology, neurobiology, and related topics. Prereq: 511-12 or consent of instructor. May be repeated. Maximum 9 hrs.

Chemical and Biomolecular Engineering (CBE)

506: Advanced Engineering Mathematics (3)

579 Advanced Biomolecular Engineering (3)

531 Advanced Chemical Engineering Thermodynamics

691 Biomolecular Kinetics and Cellular Dynamics (3). Computational cell biology (Steve Abel).

Computer Science

462: Parallel Programming (3) Principles and practice of parallel computing; design, implementation, and evaluation of parallel programs for shared and distributed memory architectures, and vector processors. Sample topics include models of parallel computers, basic communication operations, performance and scalability of parallel systems, and programming techniques including multi-threading and message passing.

494/594 Special Topics in Computer Science Previous offerings include: Introduction to Data Mining (3) Michael Berry. Computational Methods for Systems Biology (3) Mike Langston. C++ Programming for non-EECS Graduate Students (3) Greg Peterson.

505 Intro to Computer Programming This course teaches competency with C++ programming and introduces other coding languages. Geared towards non-EECS science students. (Greg Peterson) Taught in Spring (3 cr).

506 Fundamentals in Computer Science This course enhances programming skills and works with various coding languages to maximize computational potential and improve data manipulation. Developed by NSF/SCALE-IT trainees, the class prepares students for graduate coursework in parallel programming and data mining.

580 Foundations (3) and 581 Algorithms (3) Prerequisite: Solid undergraduate training in Computer Science.

581 Algorithms (3) Analysis of algorithms and relevance of analysis to design of efficient computer algorithms. Sorting, searching, graph algorithms, pattern matching, dynamic programming, efficient approximation algorithms.

Note: Introductory computer science is offered in CS311 Discrete Structures and CS380 Algorithms.

Ecology and Evolutionary Biology (EEB)

406 Models in Biology (3)

585 Mathematical Evolutionary Theory (3).

681 Advanced Mathematical Ecology (3).

Environmental Engineering

655 Environmental Systems Biology (Hazen, Loeffler). Inter-disciplinary study of complex interactions from the molecular level (i.e., molecules) up to and including the ecosystem level (e.g., nutrient cycling models). Hands-on

analysis and system integration of 'omics' data will be emphasized. Discussion topics will include metabolic and kinetic interactions, signaling networks, control theory, and modeling approaches leading to predictions. Recommended Background: Previous coursework in microbiology or environmental microbiology.

Graduate School of Medicine

541 Molecular Basis for Metabolic Disease (4). Metabolic disorders of humans and animals. Emphasis on molecular mechanisms in inborn errors of metabolism, toxic reactions, and deficiency states. Clinical and pathologic correlations. Prerequisite: BCMB 410-419 or equivalent.

CMVM612 Journal Club in Molecular Oncology (1).

Mathematics

405 Models in Biology (3). Principles and application of mathematical modeling; critical analysis of model assumptions. Difference and differential equation models in biological systems. Qualifies as credit for IGMCS and IGERT students (Paul Armsworth).

525 Statistics I (3).

526 Statistics II (3).

527 Stochastic Modeling (3). Variable topics in probability applied to real world situations. Topics may include queuing theory, branching processes, Monte Carlo simulation, stochastic finance and other topics as selected by instructor.

Microbiology

594 Grant Writing (3). Also discusses scientific ethics. Course is equivalent to BCMB530.

650 Topics in Microbial and Molecular Genetics (3). Special Topics, often with invited speakers.

Plant Sciences

571 Design and Analysis of Biological Research (3). Statistical procedures including analysis of variance, regression, etc.

572 Least squares analysis (3). Statistical models including least squares estimation and hypothesis testing; mixed model methodology; full-rank and non-full rank situations; covariance structures, estimation of variance components.

605 Special Problems in Plant Breeding and Genetics - Plant Genomics (1-3). May be repeated. Maximum 6 hours.

Statistics

474 Data Mining/ Business Analytics (3) (Schmidhammer).

537/538 Statistics for Research I and II (3,3). Principles and application of statistical methodology, integrated with computational software applications (SAS). Recommended for GST students as an alternative to 571/572 (Bozdogan).

563/564 Statistical Inference I and II (3,3). Intermediate Statistics.

571/572 Statistical Methods (3) and Applied Regression Analysis (3). Math background required. Recommended for students who pursue a Masters or Minor in Statistics. Also offered as online course in 2nd Summer session (Ramon Leon).

577 Data Mining Methods and Applications. Understanding and application of data mining methods. Data preparation; exploratory data analysis and data visualization; predictive modeling using generalized linear models, decision trees, neural networks; model assessment; cluster analysis; association analysis; and other topics. Use of standard computer packages.

578 Categorical Data Analysis (3).

583 Special Topics: Applied Statistics (3). (Bozdogan).

677 Statistical Modeling (3).

679 Multivariate Statistical Modeling (3).

Courses in Other Programs

Animal Science: ANSC571 Design and Analysis of Biological Research (3).

Appendix 2 – Committee Meeting Guide

Summary: GST Format for Ph.D. / M.S. Committee Meetings

1. *Hand out a curriculum vitae.
2. *Review course work completed. Discuss courses needed and planned to take in order to complete degree requirements.
3. Discuss status of comprehensive exam (Expected date or result). If a pass, apply for admission to candidacy.
4. Discuss research progress:
 - a) *Hand out copies of all abstracts of presented work and manuscripts submitted or published
 - b) *Hand out a written summary of research progress that covers the information that will be presented during your committee meeting. It should begin with an introduction to your problem with sufficient background information, a statement of your goals, a summary of research findings with supplementary figures or documentation, a brief discussion and a statement of future directions. This is more than an outline and should contain sufficient detail to allow your committee members to critically review the material in preparation for your meeting.
 - c) Give a presentation (20-60 min, depending on circumstances).
5. *Hand out a proposed outline of the Ph.D. dissertation [during last meeting before defense]
6. Discuss times for next meeting or dissertation defense

*Give to committee members a few days before the meeting.

Appendix 3 - The Comprehensive Examination

Note: The GST Graduate Student Organization has a file of informal guidelines (FAQ's) to help with proposal preparation. Note: GST reserves the right to modify the procedures as needed.

The comprehensive exam of the GST Ph. D. program consists of submission and oral defense of a research proposal prepared by the student to test independence and ability to conceptualize research. The exam should be taken by the first semester of the third year of study. An examination committee (usually five members from the GST faculty including one chairperson) will be appointed by the faculty member overseeing the exams, who is her/himself appointed by the GST director. The committee will be tailored to the student's field of research or topic of the proposal, but typically also includes members from outside the student's field. The examination committee may include one or more members of the student's dissertation committee. The student's dissertation advisor (major professor) will not be a member of the examination committee. The committee chairperson will be the liaison for questions during the exam process. Written communication to the student about the exam, including feedback on the pre-proposal and a summary of performance on the written and oral parts of the exam will come from the committee chair.

The preparation of a research proposal as the comprehensive examination is a format designed to assess the student's ability to assemble, analyze, interrelate and interpret factual information, as well as the ability to present hypotheses and design experiments to test the hypotheses. Attributes of creativity and imagination, although difficult to ascertain, are expected of the Ph.D. candidate.

The research proposal will be in the candidate's major field of research, on a topic selected by the student. The topic cannot have major overlap with the candidate's dissertation research, although similar techniques may be used. Although some aspects of the advisor's research program may be a component of the candidate's proposal, the candidate's proposal should present new and original approaches to solving a problem in the major field. The advisor may not comment on the scientific direction or technical aspects of the candidate's project; however, general mentoring, for example sharing experience and advice about the exam process, is not prohibited. The advisor is expected to inform the exam committee of the originality of the proposed project (see below).

The major ideas and hypotheses to be tested in the submitted document shall be the work of the candidate. It is expected that the proposal be written well. Although citation of other work is critical, plagiarism is never acceptable and will result in failing the exam. Some help may be obtained from student colleagues in editing the proposal with respect to organization, vocabulary and grammar. Interaction with fellow students, faculty, and others both on and off campus is encouraged to aid with gathering information with regard to specific experimental systems and protocols. Students are also encouraged to interact with their fellow students and postdoctoral fellows as they organize their oral presentation; practice sessions are encouraged.

Each student receives an individual 6-week exam schedule that typically runs late-September to early-November. The student begins by developing a preproposal and presents it to his/her exam committee by the given date (5pm is the default due time for all assignments). The preproposal should total no more than 2 pages, including figures, but excluding references. It should include the topic of the proposal, the hypotheses to be addressed, a short version of the anticipated experimental plan, and key references. The plan must encompass at least two of the five GST focus areas (Genetics/Genomics, Structural Biology/Proteomics, Computational Molecular Biophysics, Computational Biology/Bioinformatics, and Analytical Technologies/Bioenergy). The examining committee has 48 hours to give feedback to the student pertaining to the scope of the preproposal: i: appropriate; ii: needs revision (with comments and suggestions); iii: not acceptable, a new preproposal is needed. The student's mentor will be asked to ascertain that the preproposal is indeed independent from the mentor's research plans and the mentor's funded, submitted, and planned grant proposals. The student has a total of one week from the submission of the preproposal to revise the preproposal and have it approved by the committee (week 1). In the exceptional case that the preproposal was not acceptable within the first week, the student is given the chance to draft a new preproposal that must be approved within the following week (week 2). In any event, the student then writes the full proposal and submits it to the committee by the end of week 5, i.e. five weeks after submitting the first preproposal.

Research proposals should be developed with an emphasis on hypothesis-driven research, rather than data-driven or design-driven projects. Students are required to submit an NIH-style or NSF-style

proposal that has the following sections: 1. Summary, 2. Specific Aims, 3. Background and Significance, 4. Preliminary Results (not mandatory), 5. Research Design and Methods, and 6. Literature Citations. Students should consult the NSF or NIH web site for detailed guidelines about these sections. **One important exception is that the page limit for sections 1-5 is 15 pages, including any figures. The proposal should be single-spaced using Arial 11 pt. font with 1 inch margins.** Other forms and sections (human subjects, animal use, cover page, budget, budget justification, biosketch, resource page, etc.) are NOT required for the proposal. Instead, the final proposal should include one additional page that addresses the following three topics:

- a. Resources Required for this Project: A paragraph or two about what will be required to accomplish the aims in the project. Resources include personnel, supplies and equipment. If specialty items are required that are not commercially available, a student should indicate what the source would be. Generally, projects should be feasible within the equipment infrastructure of UT-ORNL. Projects may also utilize reagents that have been published in the peer-reviewed literature. If access to facilities at other institutions will be needed, students should be prepared to justify the request and ascertain how access would be arranged.
- b. Timeline: Proposals should be developed with the goal of accomplishing the work within a total of 3 years. A student should indicate in this section what the projected time frame is for completing the various subaims within that 3-year window.
- c. GST Focus Areas: A REQUIREMENT for this exam is that students use methods involving at least 2 of the 5 GST Program Areas: Genetics & Genomics, Molecular Biophysics, Structural Biology, Analytical Technologies/Bioenergy, and Bioinformatics & Computational Biology. The student should provide a paragraph indicating which areas are included, with a brief description of the approaches that fall within each area. It is not required that the two areas are given equal weight.

The student will send the written proposal to all members of the examination committee by the 5-week deadline. One week later the student will give a 45 minute oral presentation on the topic and proposed experimental plan. The audience will include the examination committee, and the student's dissertation adviser. This presentation is open to the GST community, and students are encouraged to attend. After the general presentation, the student will be tested orally by the examination committee only. The oral questioning need not be limited to the specific topics presented in the proposal and the oral defense. The criteria for evaluation of the research proposal are described below. The committee will rule whether the exam was passed or failed. Under exceptional circumstances, the committee will issue a conditional pass, make critical comments in writing, and the student will revise and resubmit the written proposal for a final pass/fail review. If the first exam is failed, the student has one additional opportunity to pass the comprehensive exam. The second attempt typically takes place in the following semester.

Each year the director will discuss these comprehensive exam policies and guidelines with the students and faculty involved in the exam.

Criteria for Evaluation of the Comprehensive Exam Research Proposal

A suitable research proposal has several elements: (1) clearly formulated hypotheses and specific aims; (2) the historical background from which the problem and the hypothesis or hypotheses emerged; (3) a series of **direct and feasible** experiments designed to test the hypotheses; and (4) a consideration of the possible forms of data which might emerge from those experiments, as well as the problems with interpreting those data. The examination committee evaluates each of these components. Following are some general guidelines to bear in mind during preparation of the written research proposal and the oral presentation. All research proposals are evaluated on similar criteria.

Originality

Is the proposed research original in the sense that it will provide significant new information and knowledge on a previously unexplored problem or unanswered question of scientific importance? In this regard, will the proposed research advance new hypotheses or utilize new experimental and/or conceptual approaches to develop new knowledge?

Problem Identification

Has the proposal clearly identified and stated a significant scientific problem that limits further expansion of knowledge and understanding of fundamental processes and principles? In making this determination, has an adequate literature review been conducted that identifies conflicting, antagonistic and supporting evidence of the research problem?

Hypotheses

What are the basic hypotheses to be tested? Can these hypotheses be falsified? What are the alternatives if a hypothesis is rejected? How do the hypotheses relate to the problem identification?

Background and Significance

Students should pay careful attention to providing a comprehensive review of the literature relevant to the topic they choose to address in this exam. Adequate background should be given on the research area, as well as on proposed methods if necessary. The background section of the proposal should be written in a way to establish the significance of the problems that will be addressed in the proposal. A well-organized research plan that is not suitably justified relative to the current state of knowledge in the chosen field will be viewed harshly. In other words, the rationale for hypotheses and proposed experiments should be well developed.

Goals and Objectives

Has the overall goal of the proposed research been identified in terms of achievements for the successful outcome of the investigation? What constitutes a successful outcome of the research? To achieve this goal, what specific objectives must be met to experimentally test hypotheses and to provide information to move the research forward?

Experimental Plan

How will the experiments be conducted and what are the appropriate controls? What are the major pitfalls to be encountered and what are the alternative strategies? Will the methods to be employed and experiments proposed provide unambiguous data and experimental results? Do they address the hypotheses presented in the proposal? A consideration of experimental limitations and anticipated problems in interpreting results frequently demand the creating of "if/then" links between the postulated experiments, which should be carefully spelled out in the proposal.

Scope

Can the experimental plan be conducted within the time frame of the proposed work? Has care been taken to ensure that the research plan is not minimalistic or overly ambitious, trying to accomplish too little or too much?

Significance

Successful outcome of the research should be measurable by contributions made to fundamental principles. What contributions will be made that will lead to new problem identification and new avenues of research? How will the results of the proposed experiments advance knowledge in the area? The significance of any research project is somewhat intangible, but good research usually leads to more questions than answers.

General Guidelines for the Student

The faculty intends that the exam process will simulate, as much as possible, the professional demands that a PhD level scientist will face while pursuing a research career. Thus, the student should adopt an approach to the exam in keeping with an attitude of professionalism. It is necessary to utilize heavily the information resources of the University, including the information and perspectives to be found in the knowledge of colleagues. As the student formulates portions of the research proposal, it is both reasonable and desirable to elicit constructive criticism of the ideas and the method of presentation, just as one should do in preparing a real grant proposal for submission to a funding agency. However, the student's major professor is ***not*** available as a consultant during the exam period. Consultation of members of the exam committee is restricted to the first week.

Last revised August 9 2018 after discussion on the GST comprehensive exam committee.

Appendix 4: ORNL security badges

Policy instituted in 2012: For the first year, personal security badges for access to the ORNL campus are ‘temporary’ badges that are sponsored by GST. These badges are on loan to the student from GST. Terrie Yeatts keeps a record of ORNL staff who are hosting/mentoring GST students. The student may check out their badge for the length of a lab rotation at ORNL. The badges may also be checked out for visits to ORNL at other times during years 1 and 2. For non-rotation visits, badges need to be returned at the end of the day.

For year 2 and following, those GST students who are pursuing their research under the guidance of an ORNL mentor will receive badges that are sponsored by the unit of their permanent mentor, not GST. GST students based at UT who wish to visit ORNL may apply for a visitor’s badge via the GST office. Such requests need to be made well ahead of each individual visit, in particular if the student is not a US citizen.

Failure to comply with the badging policy will result in revocation of access privileges.

Appendix 5: PH.D. REQUIREMENTS CHECKLIST for GST

NAME: _____ **Date:** _____ **Joined GST:** _____
Sem / Year

A. DISSERTATION COMMITTEE

Advisor/Chair: (1) _____

Committee Members: (2) _____ (3) _____

Committee Members: (4) _____ (5) _____ (optional)

When did you submit your Doctoral Committee Appointment form? _____

Committee Meetings (dates):

(1) _____ (2) _____

(3) _____ (4) _____

(5) _____ (6) _____

B. CORE COURSES (27hr)

FALL 2017: 13hr total completed (Yes/No, Sem.& Year)

LFSC 507 Bioinformatics, 3hr _____

LFSC 520 GST I, 4hr _____

LFSC 515 Intro to GST I, 1hr P/NP _____

BCMB 511 3hr _____

LFSC 505 Research Rotation I, 1 hr _____

Advisor: _____

Presentation Title: _____

LFSC 505 Research Rotation II, 1hr

Advisor: _____

Presentation Title: _____

SPRING 2018: 6h total

LFSC 541 Colloquium, 1hr P/NP _____

BCMB 512 3hr _____

LFSC 505 Research Rotation III, 2hr _____

Advisor: _____

Presentation Title: _____

C. ADDITIONAL COURSES

LFSC 541 Colloquium (req. every Spring): Sem: _____ Sem: _____
Sem: _____ Sem: _____ Sem: _____

LFSC 615 Journal Club (or equivalent; required each semester beginning in the 2nd year)

Sem: _____ Topic/Title: _____
Sem: _____ Topic/Title: _____
Sem: _____ Topic/Title: _____
Sem: _____ Topic/Title: _____
Sem: _____ Topic/Title: _____
Sem: _____ Topic/Title: _____

Any 600 level courses graded A-F (6 hr total)

Course: _____ Topic/Title: _____
Course: _____ Topic/Title: _____

Other courses

Title: _____ Sem: _____
Title: _____ Sem: _____
Title: _____ Sem: _____
Title: _____ Sem: _____

Summary B. and C. Coursework

30 graded (A-F) graduate credits YES/NO
6 graded (A-F) 600-level credits: YES/NO
48 total graduate credits YES/NO (not counting LFSC 600 or LFSC500 LFSC502)
24 LFSC 600 credits YES/NO
72 total graduate credits YES/NO

D. TEACHING ASSIGNMENTS: (2 semesters are required)

Sem: _____ Class: _____ Days/Time _____
Sem: _____ Class: _____ Days/Time _____

E. COMPREHENSIVE EXAM (Year 3; P/NP grade)

Committee Members:

(1) _____ Chair _____ (2) _____ (3) _____
(4) _____ (5) _____

Examination Date: _____ Passed? _____

Re-Examination Date: _____ Passed? _____

F. DISSERTATION HOURS (LFSC600, P/NP, starting after passing the prelim exam; at least 24 credits and continuous enrollment for at least 3 credits, including summer, are required once you start enrolling in LFSC600).

Sem: _____ Sem: _____ Sem: _____ Sem: _____

Sem: _____ Sem: _____ Sem: _____ Sem: _____

Sem: _____ Sem: _____

G. GRADUATION REQUIREMENTS (see <http://gradstudies.utk.edu> for additional details)

Date: _____

Admission to Candidacy forms submitted (after passing the compr. exam): _____

Admission to Candidacy approved (one full semester before graduation): _____

Graduation Application form submitted: _____

Scheduling Defense of Dissertation form submitted: _____

Seminar rooms reserved for dissertation defense: _____

Dissertation submitted to committee (two weeks before defense): _____

Defense passed: _____

Dissertation in final form: _____

Dissertation approval: _____

Submission of Dissertation: _____

All requirements for termination met (date): _____

Appendix 6: M.S. - REQUIREMENTS CHECKLIST

NAME: _____ Date: _____ Joined GST: Fall 2012
Sem / Year

Please make a master copy of this checklist and forward a completed checklist to the Chair of the Graduate Affairs Committee once a year. Keep the master copy and copies of your completed checklists on file with your CV and transcripts.

A. THESIS COMMITTEE

Advisor/Chair: (1) _____

Committee Members: (2) _____ (3) _____

When did you apply for approval of your Thesis Committee? _____

Committee Meetings (dates):

(1) _____ (2) _____

B. CORE COURSES (24hr)

FALL 2017: 13hr total completed (Yes/No, Sem.& Year)

LFSC 507 Bioinformatics, 3hr _____

LFSC 520 GST I, 4hr _____

LFSC 515 Intro to GST I, 1hr P/NP _____

BCMB 511 3hr _____

LFSC 505 Research Rotation I, 1hr _____

Advisor: _____

Presentation Title: _____

LFSC 505 Research Rotation II, 1hr _____

Advisor: _____

Presentation Title: _____

SPRING 2018: 6h total

LFSC 541 Colloquium, 1hr P/NP _____

BCMB 512 3hr _____

LFSC 505 Research Rotation III 2hr _____

Advisor: _____

Presentation Title: _____

C. ADDITIONAL COURSES

LFSC 541 Colloquium (required in Spring): Sem: _____ Sem: _____

LFSC 615 Journal Club (or equivalent; required each semester beginning in the 2nd year)

Sem: _____ Topic/Title: _____
Sem: _____ Topic/Title: _____
Sem: _____ Topic/Title: _____

Other courses

Sem: _____ Title: _____
Sem: _____ Title: _____

D. THESIS (LFSC500, P/NP, 6 credits are required)

Sem: _____ Sem: _____ Sem: _____

Summary B.-D. Coursework

24 graded (A-F) graduate credits YES/NO
6 LFSC500 credits YES/NO
30 total graduate credits YES/NO

E. TEACHING REQUIREMENT: (1 semester)

Sem: _____ Class: _____ Days/Time _____

F. GRADUATION REQUIREMENTS (see <http://gradstudies.utk.edu>)

	Date:
Admission to Candidacy Forms Submitted (1 semester before graduation): *****	_____
Graduation Application Submitted: *****	_____
Thesis submitted to committee (two weeks before defense): *****	_____
Thesis defense scheduled: *****	_____
Seminar Room Reserved: *****	_____
Thesis in Final Form: *****	_____
Thesis Approval: *****	_____
Submission of Thesis: *****	_____
All requirements for termination met (date): _____ *****	

Appendix 7: Pertinent Web Pages

- international students
 - Center for International Education (international.utk.edu)
 - International House (ihouse.utk.edu)
 - ITA Testing Program (tiny.utk.edu/ita-testing)
- professional development & training
 - Office of Graduate Training and Mentoring (gradschool.utk.edu/training-and-mentorship)
 - Best Practices in Teaching Program (tiny.utk.edu/bpit)
 - UT Libraries Information for Graduate Students (libguides.utk.edu/graduate)
 - Center for Career Development (career.utk.edu)
 - Tennessee Teaching and Learning Center (tenntlc.utk.edu)
 - UT CIRTLL: Center for Integration of Research and Teaching (tlc.utk.edu/cirtll-program-center-for-integration-of-research-and-teaching/)
 - Experience Learning (experiencelearning.utk.edu)
- funding
 - costs and funding opportunities (tiny.utk.edu/grad-funding)
 - Graduate Student Senate Travel Awards (gss.utk.edu/travel-awards)
 - Financial Aid and Scholarships (onestop.utk.edu/financial-aid)
- student resources
 - Counseling Center (counselingcenter.utk.edu)
 - departments and college websites
 - Graduate School (gradschool.utk.edu)
 - Graduation Deadlines (tiny.utk.edu/grad-deadlines)
 - Graduate School Forms (gradschool.utk.edu/forms-central)
 - Graduate Catalog (tiny.utk.edu/grad-catalog) <https://catalog.utk.edu/index.php?catoid=27>
 - Student obligations and appeals process (tiny.utk.edu/rights-obligations)
 - Graduate Student Senate (gss.utk.edu)
 - Office of Graduate Admissions (gradschool.utk.edu/admissions)
 - Student Conduct and Community Standards (studentconduct.utk.edu)
 - Office of Equity and Diversity (oed.utk.edu)
 - Sexual Misconduct, Relationship Violence, and Stalking (sexualassault.utk.edu)
 - Office of Multicultural Student Life (multicultural.utk.edu)
 - Office of Research Integrity (research.utk.edu/compliance)
 - Thesis/Dissertation Consultant (gradschool.utk.edu/thesesdissertations)
 - Office of Information Technology (oit.utk.edu)
- Statewide resources (for all UT employees including students)

- Employee Assistants Program 855-HERE4TN (855-437-3486). Offers free, confidential assistance to employees and their families and provides a wide range of resources to support employees dealing with many challenges, including but not limited to: Suicidal thoughts; Grief and loss; Depression, anxiety and stress; Family concerns.
- Tennessee Suicide Prevention Network (tspn.org). 1-800-273-TALK (8255). Or: Text TN to 741741. Available 24 hours a day to help anyone experiencing suicidal thoughts or a mental health crisis.