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

GRADUATE STUDENT HANDBOOK

Eleventh Edition
2015

The University of Tennessee
Graduate Program of Genome Science & Technology

Student Handbook

Table of Contents

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

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.

Overview

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 Division of Biological and Environmental 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 40,000 human genes, and to develop experimental and computational tools for data analysis. Concomitantly, researchers are also studying the genetic makeup of many other organisms, including numerous bacteria, the fruit fly Drosophila, the mouse, plants, such as Arabidopsis and poplar, and others. Access to entire genome sequences has revolutionized biology, leading to new discoveries in the health sciences, with rapid advances in drug design, neuroscience, cancer biology, and microbial pathogenesis. Genomics also impinges in numerous ways on 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 16-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/studentsAlum.html). To this end, the program emphasizes a solid foundation in genetics, molecular and cellular biology, biochemistry, and computing, followed by more specialized training.

Academic and Research Climate

The University of Tennessee (UT) is the only state-supported 'Carnegie I' 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 and genome annotation, analytical technologies such as mass spectrometry, structural biology using neutron scattering, nanotechnology, plant and microbial genomics, mammalian genetics, 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.

This Handbook does not deviate from established graduate school policies as noted in the Graduate Catalog <http://catalog.utk.edu/index.php> but rather provides the specific ways in which those policies are carried out. Graduate students are expected to be aware of and satisfy all regulations governing their work and study at the university. It is important to remain in good academic standing in order to not compromise progress in the program or financial support.

What to expect - The first year

Upon arrival, the First Year Advisory Committee welcomes the new graduate students. The committee 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 four laboratory rotations, two each during the Fall and Spring semesters. A series of weekly informal orientation 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.

A yearlong introductory course (GST I and GST II) sets the stage for more advanced courses by introducing the process of scientific inquiry on a genome-wide scale. The First Year Advisory Committee may also recommend background undergraduate courses or other tutorials to help a student participate fully in this multi-faceted program. Access to the ORNL campus requires clearance of a security check. Therefore, Fall students should not plan on a lab rotation at ORNL until October. Labs at UT are available for rotations immediately.

The University publishes an 'Academic Calendar' and a 'Timetable' of classes (see http://registrar.tennessee.edu/currentstudents.shtml) 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, appication to graduate, and scheduling of the final thesis defense require the submission of specific forms to the UT Graduate School office (http://gradschool.utk.edu/default.shtml).
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

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.

graduate school. GST students must 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. Student who receive an NP are not in good standing; a second NP will result in dismissal from the program.

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

Your progression through the program

The primary and authoritative source of information concerning the major degree requirements of the graduate program are published in the *UT Graduate Catalog* (http://diglib.lib.utk.edu/dlc/catalog/). This *Student Handbook* contains guidelines for the GST program, which supplement those in the Graduate Catalog. 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 also lists a succinct synopsis of degree requirements.

Year 2: Prior to the start of the first semester of your 2nd year, you need to identify an adviser/major professor. Careful thought should be given to this important step, and academic, personal, and financial constraints need to be considered. Your adviser directs your research and helps you choose courses beyond the *Core Curriculum*. As your program of research takes shape during this semester, you form a *Thesis/Dissertation Committee*, ('your committee') consisting of 3-5 faculty members including your adviser. Your committee's main responsibility is to guide you through your 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 Chair of the Graduate Affairs Committee will occasionally be in contact to ascertain whether you have passed various milestones. A preformatted checklist should make it easy for you 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. If you pass and have completed all major coursework, you should apply for *Admission to Candidacy*. 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. Time limits for completion of the degree are given in the Graduate Catalog.

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 GST and by the Graduate School. On the other hand, 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.

"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* (see *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 LS500 (thesis).
  -> The majority of course credits are collected through the *core curriculum*.
  -> Sign up for LS541 (Colloquium) every Spring, beginning with the 2nd semester.
  -> Participation in one journal club each semester is also expected; one of these should be LS516 (Ethics).
- 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

A summary of the procedures to be followed in the progression of the Ph.D. degree is provided in *The Graduate Catalog*. Degree requirements, compliant with regulations of the Graduate School, are summarized briefly:

- Satisfactory completion of 4 lab rotations with two of the five scientific 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 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 and at the 600 level.
  -> To fulfill these requirements, students ought to
  a) Complete the *Core Curriculum*
  b) Sign up for LS541 (Colloquium) every Spring beginning with the 2nd semester
  c) Participate in one Journal Club each Fall and Spring semester beginning with the 2nd semester
  d) Complete 6 graded credits at the 600 level.
  e) Participate in LS516 (Scientific Ethics) once after the 1st year (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 LS600 (Doctoral Research and Dissertation). Doctoral students who have begun registration for LS600 must register for it in Summer. Minimum registration for LS600 is three (3) hours.
- 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.

Rotations

Students complete four lab rotations during the first year (two each in Fall and 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 LS505. It is expected that students work 10-20 hours per week in their host laboratory. Of the five scientific areas of emphasis in the GST program (see *Overview)* at least two must be represented. Students are encouraged to contact potential rotation advisers ahead of time, keeping in mind that rotations at ORNL require lead time for security clearance. The First Year Advisory Committee 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 composed of several emphasis areas 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 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	LFSC 521	GST II - Analytical Technologies (4 hr)
	BCMB 512	Advanced Molecular Biology (3 hr)
	LFSC 517	Bioinformatics and Computational Biology II (3 hr)
	LFSC 541	Colloquium (1 hr, not graded)
	LFSC 505	Research Rotation (2 hr)
Year 1, Summer	LFSC 500	Thesis (up to 6 hr)

Apart from the rotations, not all of the core courses have to be completed during the first year, although LS 520, LS 521, 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 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 LS505, LS515, and LS541. In addition, at least one course from each of the following pairs—LS520/LS521, BCMB511/BCMB512, and BCMB510/LS507—should be taken by all students. Core courses for Computational Molecular Biophysics are: LS521 and at least two out the three following courses, BCMB511&510, BCMB560, and LS596. In all cases, the course selection for first year students must be made in consultation and with approval of the First Year Advising Committee.

"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. Keep in mind that a total of 30 hours must be graded A-F and of these 6 or more must be graded at the 600-level. Students should continue course work with at least two 3-credit courses in the second year to maintain reasonable progress in the program. To complete the course requirements, options from the following two groups of courses may be used:

a. GST courses

- 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 516 Introduction to GST – II; Scientific Integrity (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).

Additional courses are required for some focus areas:

- Structural and Nanoscale Biology: At least one of BCMB560 or LS596

Additional courses are recommended for some focus areas:

- Molecular Genetics and Systems Biology: BCMB515 (Experimental Techniques, Fall)
- Bioinformatics: BCMB515 (Fall)
- Structural and Nanoscale Biology: BCMB515 (Fall)
- Analytical Technologies for Bioenergy & Environment: BCMB515 (Fall)

Popular courses to prepare for the Comprehensive Exam are BCMB530 and Micro594 (Spring).

c. Students focusing on their dissertation or thesis research maintain full-time status by enrolling in LS500 or LS600, respectively, under the direction of their advisor. 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.

d. 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 six credits for Fall and Spring and 3 credits in Summer. From the 2010 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. (...). -- "Graduate Students who hold exactly 20 hours/week graduate assistantship may enroll in 6 credits minimum and still be considered full-time." 6 hours in Fall and Spring is the minimum load for international students to maintain F-1 visa status http://international.utk.edu/students/maintaining_status.shtml).

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, from the Graduate Assistant Handbook (http://gradschool.utk.edu/CurrentStudents.shtml): "Remember that to maintain insurance coverage, you must enroll for at least 3 graduate credit hours per term, but to avoid having to pay the health service fee (~$100 for using the Student Health Service), you must be enrolled for at least 9 hours each semester, including summer."... Page 14: Tax advice "You must be enrolled in at least three student credit hours to be exempt from FICA deductions" (Social Security Tax collected from your paycheck).

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/). 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.

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 Teaching Assistants (TAs) for two semesters during their tenure at UT, and M.S. students serve one semester. This normally occurs during the second year, although there are exceptions. 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.

Students whose native language is not English must pass the OPIC test, or equivalent, which is administered before the start of the each semester (http://gradstudies.utk.edu/speaktest.shtml), before they may serve as TA s with a classroom assignment. TA assignments are coordinated by the Graduate Affairs Committee of the BCMB department in consultation with the GST Director.

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://web.utk.edu/~glenn/Plagiarism.html; July 2008).

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. As you know, this stylistic element is not commonly used in scientific parlance. The university honor statement states that even using others' 'ideas' without attribution can constitute plagiarism. 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, attention is necessary to avoid plagiarism.

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.

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, preferentially every six months, but at least once a year, starting in the second year. The experience of a first committee meeting is good preparation for the Comprehensive Exam. Students who do not form a committee within a reasonable time are not in good standing in the program and may lose their 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. Your major professor chairs your committee. 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.

b) Are you making progress in your coursework? – Bring a table of courses taken and/or a transcript. The committee will want to hear about your interests and will also recommend and approve 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.

It is the responsibility of the committee to direct your research and 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 Chair of the Graduate Affairs Committee of your committee meeting.

Your Dissertation Committee must be approved by the UT Graduate School. Obtain the required Doctoral Committee Appointment form (http://gradschool.utk.edu/gradforms.shtml) and bring it to your first committee meeting for signature. The GST Director must sign it as well. Faculty members must be approved by the Graduate School to direct Doctoral Dissertation research, but it is the responsibility of the committee members to seek approval. Faculty are usually approved through just one program (BCMB, GST or Micro...) and this is the program that should be listed.

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 UT faculty members that is assembled by the Chair of the GST Comprehensive Exam Committee and takes place during the Fall semester of the 3rd year. A detailed description is found in Appendix 4. 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 chair(s) of the Comprehensive Exam Committee will discuss the comprehensive exam policies and guidelines with the students and faculty involved with the exams.

Admission to Candidacy

Once several major degree requirements have been met, the student may apply for Admission to Candidacy (http://gradschool.utk.edu/gradforms.shtml). 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, the grades received, and 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

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 one week 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 by 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://web.utk.edu/~thesis). Consultants are available to advise on mechanical details such as margins, page numbering, etc.

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. It is customary for the major adviser to receive a hardbound copy. Student ought to provide copies to the other committee members as requested. They may be softbound copies.

Checkout at the end of your program: The GST program 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 you to fill out <http://hr.utk.edu/docs/final_pay_release.pdf > before it will release the final paycheck. Students who leave UT before the end of their final semester (for a new job) become personally responsible for the tuition/fees of that final semester. The tuition waiver does not kick in automatically. UT will track down students who left without paying those fees. Students who graduated being in good standing may request that the program pay the fee for them.

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*

Financial Support of Graduate Students

Typically, the GST program supports students in both the Ph.D. and the Master's track for the first two years. During this period, students are expected to serve as graduate teaching assistants for two 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. Certain fees charged by the university, such as the 'Activity Fee' and 'Technology Fee', are the responsibility of the student. The Graduate School publishes a Graduate Assistant Handbook that provides additional guidance on policies. Employment beyond the programmatic assistantship is generally strongly discouraged because the associated commitment would almost undoubtedly compromise progression toward the degree. Students are, however, encouraged to seek financial support for their course of study in the form of fellowships awarded by the University of Tennessee, 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 university's Graduate Student Travel Fund, which is administered by the Graduate Student Senate (GSS). Typically, costs are split between various sources including the travel budget of the mentor's research grant.

"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*

Appeals Procedures

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 helpful 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. At this point, the Graduate Affairs Committee may function in an advisory role to the Director. If no satisfactory resolution can be achieved within the GST program, you may present your case according to the University procedures described in *Hilltopics – A Student Handbook.*

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 http://diglib.lib.utk.edu/dlc/catalog/. See the UT Timetable of Classes (https://my.tennessee.edu/portal/page?_pageid=44,43618&_dad=portal&_schema=PORTAL) 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 (Fortran, Perl).

510 Special Topics in Life Sciences (1-3) Specializations in biotechnology; cellular, molecular, and developmental biology; environmental toxicology; ethology; plant physiology and genetics; and physiology. May be repeated.

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

516 Introduction to Genome Science and Technology II (1) Scientific Integrity. Counts as Journal Club (S/NC).

517 Bioinformatics and Computational Biology II (1-3) Comparative genomics and bioinformatic analysis of protein and DNA sequences (Jouline).

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) Core course on analytical technologies including but not limited to proteomics, X-ray crystallography, nuclear magnetic resonance, atomic force microscopy, next-generation sequencing, and other topics. Lecture.

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).

595 – Survey of Biology for Computational Researchers: 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 (3).

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).

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).

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 (offered in the 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. (offered in the 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. Prereq: 511 or consent of instructor. Part of GST core curriculum. (offered in the Spring).

513 Advanced Protein Biochemistry and Cell Biology II (3) Advanced topics of cellular function and regulation of cell division and growth, and structure and function of supramolecular structures: cytoskeleton and cell junctions and adhesions. Prereq: 511.

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

517 Physical Biochemistry (3). Advanced topics course. Specific topic area varies with instructor.

522-523 Advanced Plant Physiology I, II (3,3)
522—Plant biochemistry and metabolism: respiration, photosynthesis, carbon partitioning, and biosynthesis of specialized plant products: terpenoids, alkaloids, phenolics and plant growth regulators. (offered Fall 2009).
523—Growth and differentiation of plants at molecular, cellular and organismal levels.
Regulation of development; macromolecular interpretation of differentiation, dormancy, germination, flowering, and senescence. Prereq: BCMB401 and 1 semester of introductory plant physiology or cell biology (offered Fall 2010).

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'). (offered in 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 - Transmission Electron Microscope (4) 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. 2 hr labs.

564 Introduction to Electron Microscopy-Scanning Electron Microscope (3) Practical introduction to techniques of electron microscopy and to scanning electron microscope. Use of microscope, introduction to darkroom techniques and digital image processing, preparation of samples for observation, and special project. Prereq: Consent of instructor. 2 hrs and 1 lab.

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.

580 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 Develomental 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.

Chemistry

511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena. Required background: Two semesters of physical chemistry.

553 Spectroscopic Characterization of Organic Compounds (2) Organic structure elucidation using spectroscopic methods: nuclear magnetic resonance, infrared, ultraviolet and mass spectrometry. Required background: Two semesters of organic chemistry.

554 Organic Spectroscopy Laboratory (1) Use of IR, UV, MS and multinuclear FTNMR spectrometers. Development of problem-solving ability in area of spectroscopic characterization of organic molecules. Prereq: 360 or equivalent. Coreq: 553.

Computer Science

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, culminating with the Kraken supercomputer. 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.

595 Scripting for web development (3) Brad Van der Zanden.

680 Emergent Algorithmic Methods in Bioinformatics (3). Includes lectures and group projects.

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

Ecology and Evolutionary Biology

504 Genome Evolution (1) Michael Gilchrist.

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. Registration Restriction(s): Minimum student level – graduate.

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).

Microbiology

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

630. Immunology (3). (Ganusov).

650 Topics in Microbial and Molecular Genetics (3). Special Topics, often with invited speakers. Previous offerings. Spring 2010: Omics-The Interface between Biology and Chemistry (Wilhelm).

680 Foundations in Microbiology (3). Explored the primary literature that describes how gene structure, recombination, and regulation of transcription were discovered in bacteria (Zinser)

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).

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) (Saxton).

Chemical and Biomolecular Engineering

CBE691-001: Biomolecular Kinetics and Cellular Dynamics (3). Computational cell biology (Steve Abel).

Appendix 2 - GST Personnel

Mail:
UT-ORNL Graduate School of Genome Science and Technology
F337 Walters Life Science
University of Tennessee
Knoxville, TN 37996-0840

Albrecht von Arnim
vonarnim@utk.edu
Director of GST
Professor, Dept. of Biochemistry Cell & Molecular Biology
Hesler Room 228
Phone: 865-974-6206

Roger Gray
rgray17@utk.edu
M305 Walters Life Science
Phone: 865-974-9561

Teresa Yeatts
tyeatts@utk.edu
F337 Walters Life Science
Phone: 865-974-1531
Fax: 865-974-0361

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

Appendix 3 – 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 4 - 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. 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 aid the student in the preparation or defense of the proposal. 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, even down to using similar wording taken from other published work, 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 1-2 pages, and should include the topic of the proposal, the hypotheses to be addressed, and 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, 5. Research Design and Methods, and 6. Literature Citations. Preliminary Results are not mandatory. 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. The 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.

Revised July 28 2015 to match established practice.

Appendix 5: ORNL security badges

Policy instituted in 2012: For the first two years, 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 years 3 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 6: PH.D. REQUIREMENTS CHECKLIST

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

Please forward a completed checklist to the Chair of the Graduate Affairs Committee once a year. Keep copies of your completed checklists on file with your CV.

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 2012: 14hr 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 _____
BCMB 510 1hr _____
LFSC 505 Research Rotation I, 1 hr
Advisor: _____
Presentation Title: _____
LFSC 505 Research Rotation II, 1hr
Advisor: _____
Presentation Title: _____

SPRING 2013: 13h total

LFSC 521 GST II, 4hr _____
LFSC 541 Colloquium, 1hr P/NP _____
BCMB 512 3hr _____
LFSC 507 Bioinformatics & Comput. Biol., 3hr _____ or equivalent, __hr _____
LFSC 505 Research Rotation III, 1hr
Advisor: _____
Presentation Title: _____
LFSC 505 Research Rotation IV, 1hr
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: _____

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)
24 LFSC 600 credits	YES/NO
72 total graduate credits	YES/NO

D. TEACHING REQUIREMENT: (2 semesters are required)

Sem: _____ Class: _____ Days/Time _____

Sem: _____ Class: _____ Days/Time _____

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

Committee Members:

(1)_____ (2)_____ (3)_____

(4)_____ (5)_____

Examination Date: _____ Passed? _____

Re-Examination Date: _____ Passed? _____

F. DISSERTATION (LFSC600, P/NP, 24 credits and continuous enrollment are required)

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 (in triplicate): _____
****
Scheduling Defense of Dissertation form submitted (Registrar): _____
****
Seminar rooms reserved for dissertation defense: _____
****
Defense passed? _____
****
Dissertation in final form: _____
****
Dissertation approval: _____
****
Submission of Dissertation:
2 unbound copies to UT Graduate School _____
1 to GST office _____
1 to each committee member _____

All requirements for termination met (date):_____
****

Appendix 7: 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 2012: 11hr 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 _____
BCMB 510 1hr _____
LFSC 505 Research Rotation I, 1hr
Advisor: _____
Presentation Title: _____
LFSC 505 Research Rotation II, 1hr
Advisor: _____
Presentation Title: _____

SPRING 2013: 13h total

LFSC 521 GST II, 4hr _____
LFSC 541 Colloquium,1hr P/NP _____
BCMB 512 3hr _____
LFSC 507 Bioinformatics & Comput. Biol., 3hr _____or equivalent, __hr _____
LFSC 505 Research Rotation III 1hr
Advisor: _____
Presentation Title: _____
LFSC 505 Research Rotation V 1hr
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 (in triplicate): _____
****
Thesis defense scheduled (through Department): _____
****
Seminar Room Reserved: _____
****
Thesis in Final Form: _____
****
Thesis Approval: _____
****
Submission of Thesis:
2 unbound copies to UT Graduate School _____
1 to GST office _____
1 to each committee member _____

All requirements for termination met (date): _____

Appendix 8: Pertinent Web Pages

• Best Practices in Teaching
http://gradschool.utk.edu/files/2009-10_BPIT-Flyer.pdf

• Center for International Education
http://web.utk.edu/~globe/index.php

• Counseling Center
www.utk.edu/counselingcenter

• GST Program
http://gst.tennessee.edu

• Funding, Fellowships, Assistantships for Graduate Students
http://gradschool.utk.edu

• Graduate School
http://gradschool.utk.edu

• Graduate Catalog
http://gradschool.utk.edu

• Graduate Student Appeals Procedure
http://gradschool.utk.edu/GradAppealHbook.pdf

• Graduate Student Senate
http://web.utk.edu/~gss

• Graduate and International Admissions
http://graduateadmissions.utk.edu

• Health Insurance Program
http://studenthealth.utk.edu/insrec_studentinsurance.php

• Housing
http://uthousing.utk.edu/sutherland/sutherlandresources.htm

• International House
http://web.utk.edu/~ihouse

• Judicial Affairs
http://web.utk.edu/~osja/

• Library Website for Graduate Students
http://www.lib.utk.edu/refs/gradservices.html

• Multicultural Student Life
http://multicultural.utk.edu

• Office for Information Technologies (OIT)
http://oit.utk.edu/

• Office of Equity and Diversity
http://oed.utk.edu

• Research Compliance/Research with Human Subjects
http://research.utk.edu/compliance/

• SPEAK Testing Program
http://gradschool.utk.edu/speaktest.shtml

• Thesis/Dissertation Website
http://web.utk.edu/~thesis/

• VolAware
http://volaware.utk.edu