Graduate Student Handbook

Effective Spring 2015

Really Useful Information

Contact Information:

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IOB OFFICE ADDRESS: Institute of Bioinformatics
Davison Life Sciences Bldg Room B118B
120 Green St.,
Athens, GA 30602-7229

Listserv Addresses

iobgrads@listserv.uga.edu (all graduate students receive and can post to this list including administrators of the graduate program and IOB director)

binfgrads@listserv.uga.edu (all graduate students only – this list is administered by the Bioinformatics Graduate Student Organization, BIGSA)

IOB Website:

http://iob.uga.edu

IOB Events/Seminar Schedule:

http://iob.uga.edu/events/upcoming/

UGA Graduate School:

http://grad.uga.edu/

Doctor of Philosophy (Ph.D.) in Bioinformatics

Curriculum Requirements:

All students who enter the Ph.D. program in the Spring 2015 semester or later are will follow the curriculum described below. Students who entered the IOB program prior to the Spring 2015 semester will have the option to graduate either under the new curriculum requirements or the curriculum in place when they entered the program. However, students must satisfy all requirements of one curriculum or the other. No mixing and matching of requirements is allowed.

Students who enter the Ph.D. program through the Integrated Life Sciences (ILS) program will take the ILS Core Curriculum for the first semester. Currently, this one semester curriculum consists of rotations; a professional development class, a responsible conduct of research class, a scientific literature reading class and a data management class (http://ils.uga.edu/admissions/curriculum/). Upon selection of Bioinformatics as a major, the student is required to follow the curriculum described below. For a suggested course schedule, see Appendix A.

IOB Ph.D. curriculum overview

Prerequisites	**Core (All Required)**	**Biology Elective (Pick One)**	**Math/Stat Elective (Pick One)**
Intro Molecular Genetics Intro Biochemistry Intro to Statistics and Probability Knowledge of a programming language Intro Calculus	BINF 8211 (3.0) CSCI 6490 (4.0) STAT 8440 (3.0)	Any graduate biology course approved by student's dissertation committee	STAT 6315 (4.0) MATH 6780 (3.0) -Others, see below
Applied Bioinformatics Elective (Pick One)	**General Electives (Pick at least Two)**	**Other Required Courses** **These do not count toward the 20 hours of coursework required by the Graduate School**	
BINF 8940 (3.0) BINF 8270L (3.0) BINF 8140 (3.0) BINF 8980 (4.0) BINF 8350 (3.0) -Others, see below	Any graduate level courses approved by student's dissertation committee, but not program prerequisites.	BINF 8060^ (1.0) IOB Seminar BINF 8061^ (1.0) IOB Student Seminar BINF 8970^ (1.0-2.0) Lab Meeting BINF 8900L*(3.0) Rotations BINF 8990 (1.0) Colloquium BINF 9000 (1.0-18.0) Dissertation research BINF 9300 (1.0-12.0) – GRSC 7770 (1.0-3.0) – required for Teaching Assistants only	

*Satisfied by GRSC 8000 in ILS Program; ^Required every semester;

Requirements for 8000 Level Courses

Graduate School rules require that students with a Master's degree take at least 16.0 credit hours of 8000 level courses, while students without a Master's degree must take 20.0 credit hours of 8000 level courses. Doctoral research (9000), independent study courses, and dissertation writing (9300) may not be counted in these 20.0 hours.

Program Prerequisites

It is assumed that students entering the program have taken introductory courses in molecular genetics, biochemistry, calculus, and statistics & probability. It is also assumed that the students are able to program in some programming language. Students who lack in any of these areas must take appropriate courses in their first year in the program. These courses may not be counted towards degree requirements.

Remedial Courses

The IOB offers two remedial courses for students who enter the program lacking prerequisite courses. These courses will not count toward degree requirements. Other prerequisite courses can be taken in other departments.

BINF 4005/6005 (2.0): Essential computing skills for biologists. This course covers the most essential computing skills for bioinformaticians and cutting-edge biologists working with large data sets such as UNIX-system commands, the R statistical package, SQL, and parallel computing on Linux clusters. An emphasis will be on hands-on computer work that demonstrates how to work with large data files and prepare them for analysis. Offered Fall semester every year.

BINF 6003 (1.0): Introduction to Computer Programming for Biologists. One-week intensive introductory programming course for students with a biological background. The course provides the students with hands-on programming experience in analysis of biological data. Offered Summer semester, when needed.

BINF 6040 (3.0): Essential Biology for Quantitative Scientists. The essential elements of biology necessary for a scientist with a background in the quantitative sciences to begin working in the biological sciences. Core biological concepts will be presented with the goal of helping computer scientists, physicists, and mathematicians become grounded in fundamental concepts in biology and their pursuit of productive areas of research inquiry. Offered Fall semester every even-numbered year.

Core Courses

All students are required to take a core of three bioinformatics courses:

BINF 8211 (3.0): Computational Applications in Bioinformatics. Advanced strategies and methodologies for large-scale data analyses in support of genomics, transcriptomics, proteomics, and studies of biological pathways and networks. Topics include gene finding, genomic rearrangements, microarray data analyses, protein function inference, protein-protein interaction prediction, and pathway and network prediction. Major data mining tools will be covered for each topic. Offered Spring semester every year.

STAT 8440 (3.0): Statistical Inference for Bioinformatics. Concepts of statistical inference for students in the life sciences, including properties of single and multiple random variables, probability distributions, maximum likelihood, Bayesian inference, and multiple testing. These topics will be mixed with applications of the statistical concepts to biological data. The course emphasizes computer simulation over mathematical manipulation.

CSCI 6490 (4.0): Algorithms for Computational Biology. Application of discrete algorithms to computational problems in molecular biology. Topics are drawn from such areas as classical sequence comparison, multiple sequence alignment, DNA sequence assembly, DNA physical mapping, genome rearrangement, evolutionary tree construction, and protein folding. Background in molecular biology is not required. Offered spring semester every even-numbered year.

Biology Elective

Students are required to take one biology course. Any graduate biology course approved by the dissertation committee and the graduate coordinator are permissible. Courses equivalent to program prerequisites will not be allowed as electives.

See Appendix C for list of suitable electives.

Math/Stat Elective

Students are required to take one elective in statistics or mathematics. Good choices for most students are STAT 6315, STAT 6220, or MATH 6780, described below. However, other courses in the Statistics or Mathematics departments can be substituted with permission of the graduate coordinator and the student's committee. Generally, such courses should require substantial mathematical manipulation and thus some introductory level courses are not appropriate. Courses equivalent to program prerequisites will not be allowed as electives. As a general rule, any graduate Statistics or Math course that can be counted as a core or elective course for a Statistics or Math Ph.D. student would be permissible as an IOB Math/Stat elective.

STAT 6315 (4.0): Statistical Methods for Researchers. Basic statistical methods through one- and two-sample inference, regression, correlation, one-way analysis of variance, analysis of covariance, and simple methods of categorical data analysis. Course emphasizes implementation and interpretation of statistical methods. Statistical software (SAS) is integrated into the course.

MATH 6780 (3.0): Mathematical Biology. The course will provide students with mathematical and computational tools necessary to model, analyze, and manipulate a variety of biological and ecological systems. Offered spring semester every odd-numbered year.

Applied Bioinformatics Elective

Students are required to take one elective course that focuses on applying bioinformatics analyses to real data. Examples include GENE (BINF) 8940, FANR (BINF) 8140, BINF 8980, PBIO (BINF) 8350, EHSC 8460(L), and MIBO (BINF) 8270L. Requests to add other courses to this list may be made in writing to the Curriculum Committee. Any such course must have a strong emphasis on applications to the analysis of experimental data.

FANR (BINF) 8140 (3.0): Functional Genomics. Fundamentals and practical applications of functional genomics in biological research. Lecture- and paper-based discussion on topics including gene discovery, genome sequencing, transcript profiling by microarray, and next-generation sequencing (RNA- Seq), regulation of gene expression, forward and reverse genetics, proteomics, metabolomics, correlation network analysis, and ecological genomics. Offered Spring semester every year.

GENE (BINF) 8940 (3.0): Applied Genome Analysis. Hands-on application of bioinformatics approaches used in whole genome analyses. Topics will include aspects of genome assembly, annotation, expression studies, ChIP-sequence, comparative genomics, and systems biology. Emphasis is placed on mastery and critical evaluation of the approaches used for whole genome analyses rather than any particular software program or approach. Offered Spring semester each year.

MIBO (BINF) 8270L (3.0): Composition, Organization, and Evolution of Genomes. Computational approaches to the study of properties of eukaryotic and prokaryotic genomes, genome evolution, and statistical and computational methods for genome analyses and comparisons. Topics include composition of prokaryotic genomes, eukaryotic chromosome structure, lateral gene transfer, genome rearrangements. Emphasis will be placed on biological interpretations of sequence data. Offered Spring semester every year.

BINF 8980, 8980D (4.0): Case studies in Systems Biology. Shared research experience in systems biology. Each semester the research case study will be either on the biological clock, hot-pathogen interactions, or marine metagenomics. Project will include genomics experiments involving microfluidics, network identification, and genomic analysis. Emphasis will be placed on transformative research accomplished on the clock, host-pathogen system, or marine ecosystem. Offered Fall and Spring semester every year beginning in Spring 2016.

PBIO (BINF) 8350 (3.0), Molecular Phylogenetics and Evolution. The course includes hands-on training of phylogenetic methods, discussions of the underlying assumptions of these methods, and an opportunity to frame and execute a term project relevant to each student's research interests ranging from the evolutionary ecology of trait evolution and diversification to the molecular evolution of gene families. With just 12-16 students in the course, lecture topics will be tailored to student interests. Offered Spring semester every year.

EHSC 8460 (L) (1.0-3.0): Environmental Genomics. Covers the background and use of new high throughput genomic tools for environmental studies. Content and credits will vary depending on subjects covered, which are modified to meet the needs of enrolled students.

General Electives

Students are required to take at least two other electives. Any selection of electives that is approved by the Graduate Coordinator and the student's committee are acceptable. However, students will not be allowed to count courses that are equivalent to program prerequisites.

See Appendix C for list of suitable electives.

Additional Electives

Student advisory committees may specify additional requirements designed to extend the breadth or depth of the student's knowledge in the area of his/her specialization. These additional requirements may include both graduate and specialized undergraduate courses deemed appropriate by the student's advisory committee. It is expected that such additional requirements will be instituted

mainly for students whose focus is more computational because these programs traditionally require more courses than biological disciplines.

Courses required for Teaching Positions

For those students who have a teaching assistantship at any point in their program, it is required they take GRSC 7770. If the student speaks English as a second language, they must pass a language proficiency exam. The exam will be coordinated through the Graduate School. If the student is unable to pass the proficiency exam, they must register for LLED 7768 or LLED 7769.

GRSC 7770 (1.0-3.0): Graduate Seminar. Provides graduate teaching assistants with knowledge of pedagogical approaches and available support systems. Special sections are reserved for international students, with focus on use of language, pedagogy, and cultural aspects of teaching in this country. Offered every year.

LLED 7768 (3.0): International Graduate Internship I. Provides international graduate teaching assistants with knowledge of pedagogical approaches and available support systems. The course focuses on cultural aspects of teaching and English language for the classroom with particular attention to pronunciation, stress, and intonation patterns. Offered Fall and Spring semester every year.

LLED 7769 (3.0): International Graduate Internship II. Provides international graduate teaching assistants with knowledge of pedagogical approaches and available support systems. The course focuses on English language for the classroom and cultural aspects of teaching with emphasis on presentation skills and audience awareness. Offered Fall and Spring semester every year.

Other Required Courses

In addition to the above courses, all students are required to take the following courses:

- BINF 8060 (1.0) (IOB Seminar) taken every Fall and Spring semester
- BINF 8061 (1.0) IOB Student Seminar) taken every Fall and Spring semester
- BINF8900L (3.0) (Lab rotation)*
- BINF 8990 (1.0) (Colloquium)
- BINF 8970 (1.0-2.0) Current Topics in Research, Lab meetings
- BINF 9000 (1.0-18.0) (Doctoral research) taken to fulfill credit load requirements after the completion of courses
- BINF 9300 (3.0-12.0) (Doctoral dissertation) minimum of 3.0 credits total

*Satisfied by GRSC 8000 in ILS Program

BINF 8060 (1.0): Bioinformatics Seminar. Seminar dealing with various topics in current Bioinformatics. Offered Fall and Spring semester every year.

BINF 8061 (1.0): Institute of Bioinformatics Student Seminar. A special seminar classed focused on student research presentations with an emphasis on presentation skills. While all students are required to attend, only students in their second year and beyond are required to present. Offered Fall and Spring semester every year.

BINF 8900L (3.0): Bioinformatics Lab Rotation. Students will be exposed to research topics and techniques by participating in the research projects of Bioinformatics faculty members. Offered Fall and Spring semester every year. Satisfied by GRSC 8000 in ILS Program.

BINF 8970 (1.0-2.0): Current Topics in Research. Subjects of current interest in Bioinformatics research. Current literature and modern analysis of research results. Course is designed to meet the specific research needs of the student. Offered at the request of faculty. This course is also used to cover student time and effort spent in research lab meetings within their chosen research laboratory. Students register for sections offered by their thesis advisor. Offered Fall and Spring semester every year.

BINF 8990 (1.0): Bioinformatics Colloquium. Students will attend bi-weekly seminars covering a range of topics in Bioinformatics. Students will discuss a relevant paper from the primary literature. Offered Fall and Spring semester every year.

BINF 9000 (1.0-18.0): Doctoral Research. Research while enrolled for a doctoral degree under the direction of faculty members. Offered Fall, Spring and Summer semester every year.

BINF 9300 (1.0-12.0): Doctoral Dissertation. Dissertation writing under the direction of the major professor. Offered Fall, Spring and Summer semester every year.

NOTE: Bioinformatics students are to take 9000 and 9300 hours in BINF only. No other department courses in 9000 and 9300 will be allowed.

Lab Rotations

Students who are not committed to a major professor upon entering the program will rotate through labs in order to find a major professor. Students will spend one third of a semester in each of up to three different labs, participating in research work in that lab (BINF 8900L). Rotations will occur on a regular schedule. See the IOB faculty Webpage for a list of approved faculty and links to their sites. (http://iob.uga.edu/faculty/)

Students who enter through the ILS program will complete rotations in their first semester at UGA. ILS students register for GRSC 8000 (Lab Rotations) and will complete three 6-week rotations during the semester. By the end of the first semester, ILS students will join a lab. ILS students will begin taking the IOB Core curriculum upon joining the Institute of Bioinformatics.

Advisory Committee

Upon arrival at the University, students will meet with the Graduate Coordinator and/or the Graduate Program Administrator for guidance and mentoring.

Because this program is interdisciplinary, students will be advised to take prerequisite courses in areas where the student does not have the necessary background.

By the end of their first year in the program, students will select their major professor and establish an advisory committee. The major professor must be a Full or Adjunct Faculty member of the Institute of Bioinformatics, and a member of the Graduate Faculty. The advisory committee must consist of the major professor and at least three other UGA Graduate Faculty members. At least two members of the advisory committee must be Full or Adjunct Faculty of the IOB. The advisory committee should be composed of representatives of both the biological and the quantitative sciences. At least one member of the advisory committee will represent the student's focused area of study e.g. computer science, plant biology, microbiology, etc., from outside the institute. This member of the committee

will provide input from outside bioinformatics and ensure that the program of study is consistent with the practices of the most related outside discipline.

Students who enter through the ILS program will select their major professor by the end of their first semester in the ILS program. By the end of their first academic year, students must establish a research/thesis advisory committee. The major professor must be a Full or Adjunct Faculty member of the Institute of Bioinformatics, and a member of the Graduate Faculty. The advisory committee must consist of the major professor and at least three other UGA Graduate Faculty members. At least two members of the advisory committee must be Full or Adjunct Faculty of the IOB. The advisory committee will also be composed of representatives of both the biological and the quantitative sciences. At least one member of the advisory committee will represent the student's focused are of study e.g. computer science, plant biology, microbiology, etc., from outside the institute. This member of the committee will provide input from outside bioinformatics and ensure that the program of study is consistent with the practices of the most related outside discipline.

The advisory committee will meet with the students no less than once a year. At each committee meeting, the major professor will be responsible for completing the Evaluation for IOB Graduate Students Form. All committee members must sign the form. The advisory committee will be responsible for mentoring the student's research and training, approving the student's program of study, administering the written and oral comprehensive examination, approving the subject for the dissertation, approving the completed dissertations, and approving the student's defense of his or her research. Students will take their comprehensive examination during their second year, supervised by the major professor, under the Graduate School guidelines. For more information, see Appendix B.

Advisory Committee form is required, see:

http://grad.uga.edu/index.php/current-students/forms/

IOB Comprehensive Examination

The comprehensive exam will be comprised of a written portion and an oral portion. The written portion will take place before the oral portion. The student should contact the Graduate Program Administrator when they have scheduled the written portion of the exam. Upon completion of the written portion, the questions and answers should be forwarded to the Graduate Program Administrator to be added to the student's academic file. The Graduate School requires at least two weeks' notice of the oral exam, therefore the student should contact the Graduate Program Administrator when scheduling the oral portion of the exam. The Graduate Program Administrator will work with the student to prepare the required paperwork for submission to the Graduate School.

The comprehensive exam must be completed by the end of the second year in the program. The recommended timeline is to complete the written portion during the Fall semester and the oral portion during the subsequent Spring semester. As part of the oral portion, students will prepare a written proposal covering their proposed dissertation research, based on NIH or NSF guidelines. This written proposal may sometimes be referred to as a prospectus. The student will then present this proposal and defend it.

For detailed instructions on the comprehensive exams, please refer to Appendix B.

Final Program of Study Form is required PRIOR to Notice of Exam, see:

http://grad.uga.edu/index.php/current-students/forms/

Dissertation Planning

A written proposal, or prospectus, is prepared as part of the comprehensive exam. This proposal will detail the breadth and scope of research the student plans to undertake during their dissertation research. It is expected that the committee will provide input on this proposal so the student can focus on a viable dissertation project. It is important to note that the student is not required to have data prior to taking their comprehensive exams.

Admission to Candidacy

The student will submit an Application for Admission to Candidacy form along with the Report of the Written and Oral Comprehensive Examination form, indicating they have passed the comprehensive exam. The Graduate Program Administrator will assist the student in the preparation of the required forms. The Application for Admission to Candidacy for Doctoral Degrees form must be filed with the Graduate School at least one semester before graduation. Once the student has been admitted to candidacy, they may register for Doctoral Dissertation (BINF 9300) credit hours.

The Graduate School prepares the Report of Written and Oral Comprehensive Examination form and sends it to the Graduate Program Administrator.

Application for Admission to Candidacy is required, see:

http://grad.uga.edu/index.php/current-students/forms/

Dissertation Approval and Defense

The student's dissertation must represent originality in research, independent thinking, scholarly ability, and technical mastery of a field of study in bioinformatics. The dissertation must also demonstrate competent style and organization (see Graduate School for guideline for theses and dissertations). While working on his/her dissertation, the student must enroll for a minimum of 6.0 credit hours of BINF 9300 (Doctoral Dissertation). Students may not register for this course until they have been admitted to candidacy. Once the student's major professor approves the final version of the dissertation, it will be distributed to the other members of the advisory committee, and a dissertation defense scheduled no sooner than three weeks after the distribution. This exam requires that all members of the advisory committee be present and is open to faculty members and graduate students. The Graduate School requires two weeks' notice of the defense exam; therefore the student will contact the Graduate Program Administrator prior to scheduling the defense and provide the Notice of Exam form at least three weeks' prior to the defense date. All but one of the members of the advisory committee must approve the student's dissertation and defense. These results are recorded and submitted to the Graduate School on the Approval Form, provided by the Graduate Program Administrator prior to the scheduled defense.

Dissertation and Final Examination Approval form is required, see:

http://grad.uga.edu/index.php/current-students/forms/

Electronic Thesis and Dissertation (ETD) Submission Approval form is required, see:

http://grad.uga.edu/index.php/current-students/forms/

Master of Science (M.S.) in Bioinformatics

Curriculum Requirements

Because of its interdisciplinary nature, the bioinformatics M.S. degree program admits students from diverse backgrounds and leads to multiple career paths, depending upon the background and interests of the students. Thus, the curriculum is designed to provide flexible training of a diverse student body while maintaining the rigor of the program.

All students are required to take BINF 8900L (Lab rotation) in their first semester in the program. Students who enter the program committed to a lab should take this course in place of research credits, but are not required to rotate. Master students are required to take BINF 8990 (Colloquium) once.

In addition, 6.0 credit hours of BINF 7000 (Master's research) and 3.0 credit hours of BINF 7300 (Master's thesis) are required for students with the thesis option. In the absence of a thesis, students will take 9.0 credit hours of 8000 level courses in an area of specialization to be approved by their committee as well as prepare a final technical report on a topic assigned by the student's advisor.

Core courses for M.S. Program

Every M.S. student needs to take the following four core courses and complete any prerequisites for these courses.

Course	Title	Credits
BINF 8211	Advanced Methods for Biological Data Analysis II	3.0
BINF 8940	Genome Analysis	3.0
STAT 8440	Statistical Inference for Bioinformatics	3.0
CSCI 6490	Algorithms for Computational Biology	4.0

M.S. Lab Rotations

Students who are not committed to a major professor upon entering the program will rotate through three labs in order to find a major professor. Students will complete three 6-week rotations in three different labs, participating in research work in that lab. Rotations will first semester of the first year. See the IOB webpage for a list of IOB faculty and links to their Web pages (http://iob.uga.edu/faculty/). All students should register for BINF 8900L in their first semester in the program. If a student is already committed to a lab, then this course will be taken in place of research credit (these students are not required to rotate). Students will choose a lab by the end of the first semester in the program.

M.S. Advisory Committee

Upon arrival at the University, students will meet with the Graduate Coordinator and/or the Graduate Program Administrator for guidance and mentoring.

Because this program is interdisciplinary, students will be advised to take prerequisite courses in areas where the student does not have the necessary background.

By the end of their first year in the program, students will select their major professor and establish an advisory committee. The major professor must be a Full Faculty member or an Associate Faculty member of the Institute of Bioinformatics, and the Graduate Faculty. The advisory committee must consist of the major professor and at least two other Graduate Faculty members. At least two members of the advisory committee must be Full or Associate Faculty of the IOB. The advisory committee will also be composed of representatives of both the biological and the quantitative sciences.

Advisory Committee form is required, see:

http://grad.uga.edu/index.php/current-students/forms/

Final Program of Study form must be submitted by the second semester of residence, but must be submitted by Friday of the second full week of classes of the semester in which the student intends to graduate.

Final Program of Study for MS Degree, see:

http://grad.uga.edu/index.php/current-students/forms/form-instruction/#ms

http://grad.uga.edu/index.php/current-students/forms/

Master's Thesis

The thesis is a report of the student's investigations under the supervision of his/her major professor and requires the approval of the major professor and the advisory committee. The thesis must demonstrate competent style and organization, and communicate technical knowledge. The thesis often includes original research in bioinformatics. It must demonstrate mastery of a particular area of bioinformatics. The student's advisory committee assures that the quality of the thesis meets the standards of the IOB and the Graduate School. The candidate must register for BINF 7300 (Master's Thesis) for at least 3.0 credit hours while working on the thesis.

Final Program of Study Form is required, see:

http://grad.uga.edu/index.php/current-students/forms/

M.S. Thesis Defense

After all course work has been completed and the thesis has been approved by the student's major professor, the thesis is submitted to the other members of the advisory committee at least two weeks before the thesis defense date. The thesis defense is an oral examination conducted by the student's advisory committee. The Graduate School requires two weeks' notice of the defense exam; therefore the student will contact the Graduate Program Administrator prior to scheduling the defense. All members of the advisory committee must be present at the defense. The advisory committee members, including the major professor, must vote on whether the student passed the defense and

record their votes. These results are recorded and submitted to the Graduate School on the Approval Form, provided by the Graduate Program Administrator prior to the scheduled defense. To pass the exam, at least two of the three votes must be passing.

Thesis Defense and Final Examination Approval form required, see:

http://grad.uga.edu/index.php/current-students/forms/

Electronic Thesis and Dissertation (ETD) Submission Approval form required, see:

http://grad.uga.edu/index.php/current-students/forms/

M.S. Graduation Requirements

Before the end of the second semester in residence, a student must submit to the Graduate School, through the Graduate Program Administrator, the following forms: (i) a **Program of Study form and (ii) an Advisory Committee form**. The Program of Study Form indicates how and when degree requirements will be met and must be formulated in consultation with the student's major professor. An **Application for Graduation form** must also be submitted directly to the Graduate School.

For forms, please see: http://grad.uga.edu/index.php/current-students/forms/

Graduate Certificate in Bioinformatics

Curriculum Requirements

Graduate students in any department at UGA can receive the Graduate Certificate in Bioinformatics by taking bioinformatics coursework. Students seeking a Certificate must be currently enrolled and in good standing in a graduate program at the University of Georgia, Athens.

The requirements for the certificate in Bioinformatics are:

1. BINF 8210: Computational Methods in Bioinformatics
2. BINF 8211: Computational Applications in Bioinformatics
3. STAT 8440: Statistical Inference for Bioinformatics
4. A single graduate level course in Biology
5. A single computer sciences course from the list below:

   CSCI 6490: Algorithms for Computational Biology
   CSCI 7010: Computer Programming
   CSCI 6140: Numerical Methods and Computing
   CSCI 6150: Numerical Simulations in Science and Engineering
   CSCI 6370: Database Management
   CSCI 6470: Algorithms
   CSCI 6490: Algorithms for Computational Biology
   CSCI 6500: Programming Languages
   CSCI 6560: Evolutionary Computation and its Applications
   CSCI 6850: Biomedical Image Analysis
   CSCI 8140: Parallel Processing and Computational Science
   CSCI 8150: Advanced Numerical Methods and Scientific Computing
   CSCI 8370: Advanced Database Systems
   CSCI 8470: Advanced Algorithms
   CSCI 8850: Advanced Biomedical Image Analysis

How to Apply for a Certificate:

Before you apply, please notify the Graduate Coordinator of the Institute of Bioinformatics one month before the end of the semester in which you intend to apply for the Certificate.

To apply for the Certificate, send a letter to the Graduate Coordinator of the Institute of Bioinformatics that includes the following: your name, your student identification (810 or 811), and the courses completed to fulfill the Certificate requirements.

For each course, include only the course prefix and number (e.g. BINF 8210) and the semester in which the course was completed. Include a copy of your transcript that shows the grades for the course used for completion of the Certificate. For courses recently completed whose grades are not included on your transcript, include a brief letter from the instructor stating that you have received a grade B or higher. This information must be received within three days following the grade role deadline to receive the Certificate within that semester.

Please note: the Certificate is not a document that is mailed to you, but a notation added to your transcript, which would say “COMPLETION OF A CERTIFICATE IN BIOINFORMATICS”.

Graduate School Requirements

The Graduate School sets forth additional requirements concerning residence, time limits, programs of study, acceptance of transfer credits, admission to candidacy, minimum GPAs, dissertation, and examinations, etc. The students should refer to the Graduate School Bulletin for details.

Probation and Dismissal Policy

The Institute of Bioinformatics reserves the right to place students on probation if they have not made sufficient academic progress. The IOB Graduate Affairs Committee will review the student’s progress in the following semester. If it is found that the student has failed to meet expectations, the student may be dismissed from the Institute of Bioinformatics.

For details on the Graduate School’s Probation and Dismissal Policies, please visit their website.

APPENDIX A:

Sample Curriculum:

First Year:

Fall: ILS students will complete the core course requirements set by the ILS program. For the most up-to-date listing of the ILS curriculum, please visit their website: http://ils.uga.edu/admissions/curriculum/

Students admitted directly to the IOB Ph.D. program will consult the IOB Graduate Coordinator to plan their course schedule for their first fall semester in the program. If admitted during the spring semester, BINF 8900L will replace BINF 9000.

Spring:	***Summer:***
• BINF 8211 • Applied Bioinformatics Elective • Biology or General Elective • BINF 8060 (IOB seminar) • BINF 8061 (Student seminar) • BINF 8070 (Lab Meeting) • BINF 8990 (Colloquium) • BINF 9000 (Research)	• BINF 6003 (if needed) • BINF 8970 • BINF 9000 • Biology or General Elective, if offered

Second Year:

Fall: (Take written exam)	***Spring: (Take Oral Exam)***	***Summer:***
• Math/Stat Elective • Biology or General Elective • BINF 8060 • BINF 8061 • BINF 8970 • BINF 9000	• CSCI 6490 • STAT 8440 • Biology or General Elective • BINF 8060 • BINF 8061 • BINF 8970 • BINF 9000	• BINF 8970 • BINF 9000

Third and Fourth Year:

Fall:	***Spring:***	***Summer:***
• BINF 8060 • BINF 8061 • BINF 8970 • BINF 9000 Any electives as recommended by advisory committee	• BINF 8060 • BINF 8061 • BINF 8970 • BINF 9000 Any electives as recommended by advisory committee	• BINF 8970 • BINF 9000 and/or • BINF 9300

Fifth Year (if applicable):

Fall:	***Spring:***
• BINF 8060 • BINF 8061 • BINF 8970 • BINF 9000 and/or • BINF 9300	• BINF 8060 • BINF 8061 • BINF 8970 • BINF 9000 and/or • BINF 9300

APPENDIX B:

Comprehensive Exams

The comprehensive exam will be composed of a written exam and an oral exam.

Written Exam

All students must take the written exam by the end of Fall semester in their second year in the Ph. D. program. If a student is unable to take the exam at this time, they may petition the Graduate Committee to delay the exam. This request must be in writing and should explain the reason for the delay and should give proposed new date for the exam. The request must be endorsed by the student's advisor and Advisory Committee.

Format of Written Exam

The exam will take place over several consecutive days, with each day allotted to one Advisory Committee member. The student may elect to have the exam in a single week (e.g. Monday-Friday), 'break' over a weekend (e.g. Wednesday-Friday, Monday-Tuesday), or (with approval from the Graduate Coordinator) over the course of two weeks, allowing for conflicts in the student's registered course schedule. Each Advisory Committee member will compose the questions and set the time limit and rules for her/his portion of the exam. However, the time limit may not exceed ten hours. Topics for the exam are determined by the committee member, in consultation with the student's advisor and other members of the committee. Exam topics are usually chosen for relevance broadly interpreted to the dissertation topic.

In general, each Advisory Committee member will devise questions that are based on their focus area. The graduate student should contact each committee member to discuss preparation for the written exams, and the faculty member's preferred format and grading scheme (pass/fail, letter, or numerical grading) for their portion of the exam. The exam may be written in any format, including essays that answer specific novel questions in the particular focus area, reviews or critiques of a research area or of specific publications, or any other format that the faculty member deems appropriate. The exam questions must be submitted to the student's major professor at least two weeks before the exam to ensure that they are consistent with the student's background and interests. The major professor may request a change in form or content in consultation with the committee member.

Grading of Written Exams

Each Advisory Committee member is responsible for grading his/her section of the written exam. Exams should be graded as soon as possible, to ensure a reasonable time frame for completion of the exam. Graded exams are returned to the Graduate Program Administrator by the student's Advisory Committee members, so the results can be recorded and reviewed by the Graduate Coordinator. There are three possible outcomes of the written exam—pass, pass with conditions or fail. No more than one dissenting vote is permitted for the student to pass both the written and oral examinations. The major professor's/co-major professors' vote of approval is required for the student to pass the examination. If the student does poorly on any section of the exam, he or she may be required to do additional coursework or directed reading and retake a portion of the exam. If the committee decides that the student has not performed at a sufficiently high level on the exam as a whole, the student may be required to retake the entire written exam at a later date, usually two to six months after the initial

written exam. Retaking the written exam should not delay the oral exam (see below). Any such requirements must be discussed and approved by the Dissertation Advisory Committee.

Oral Exam

Students must complete the oral exam by the end of Spring semester in their second academic year in the Ph.D. program. If a student enters the program in the spring or summer semester, this two year span begins in their first fall semester in the program. If a student is unable to take the exam within the set parameters, they may petition the Graduate Committee to delay the exam. This request must be in writing and should explain the reason for the delay and should give a proposed new date for the exam. The request must be endorsed by the student's advisor and Advisory Committee. Because of the importance of the oral exam, long delays will not be approved except in exceptional circumstances.

The oral exam includes two parts: a written research proposal (prospectus) based on the student's proposed dissertation research, and an oral exam based on the presentation and defense of this proposal. One purpose of this exam is to evaluate students' abilities to develop a practical and coherent approach to a problem in their interest areas; another purpose is to encourage them and their committee members to focus as soon as possible on a potential dissertation subject. All members of the student's Advisory Committee must be present for the oral exam, either in person, or by teleconference, if necessary.

According to UGA Graduate School rules, the oral exam is a public exam. The Graduate School much be notified at least two weeks before the examination so that the Graduate School can publish notice of the exam, and send the required paperwork to the Graduate Program Administrator. The students should send the necessary information to the Graduate Program Administrator using the Notice of Examination form, at least three weeks prior to the oral exam date.

Research Proposal Guidelines

The written research proposal will take the form of an NIH or NSF grant proposal (but without the budget and human subject/animal use approvals), which is prepared by the student as a possible dissertation research prospectus. The student should consult with their major professor regarding the exact format of the proposal but should follow NIH or NSF grant preparation instructions (e.g. the font size should be at least 11 pt, and the document should be single-spaced, with numbered pages, and one inch margins). In general, the proposal should include an introduction or background section reviewing the relevant literature, major hypotheses, specific aims for the project, preliminary results (optional), and the proposed methods for achieving the specific aims. This should outline specific procedures to be performed for each aim, and include potential outcomes, potential problems, and alternative approaches. The proposal should be concisely written, and should be no longer than 15 pages (excluding references). Numbered tables and figures with legends should be embedded into the appropriate sections of the text, with full-page copies of each figure included as appendices (not included in the page limit). The proposal must be presented in writing to the Advisory Committee at least two weeks before the oral preliminary exam.

The proposal does not have to be based on preliminary results already obtained by the student. The purpose of this proposal is to evaluate the student's ability to develop and present a coherent, logical, and well-thought-out research project in the area of their thesis research. As such, while the student may consult with their major professor regarding the written proposal prior to distributing it to their committee, the proposal should represent the student's independent work.

The research plan in the dissertation proposal is not meant to be a blueprint for completion of the degree – it is expected that changes in the actual progress of the project may occur over time, in consultation with the student's Advisory Committee and advisor.

Oral exam guidelines

The oral exam will begin with the student delivering a 40-50 minutes oral presentation based on the written research proposal. At any time during the presentation, the committee (and any other faculty members who may be present) may question the student on any subject relevant to the proposal. In order for the oral exam to assess the student's capacity for independent thinking, the major professor is not allowed to answer questions on the student's behalf. To ensure this, another member of the student's committee will be designated by the major professor to be in charge of the exam. If deemed necessary by the presiding committee member, the major professor may clarify some questions or may question the student in limited areas. In general, the oral exam should last about 2 hours, although there is no specified time limit.

Oral exam grading

As with the written exam, a student may pass, pass with conditions, or fail the oral exam. No more than one dissenting vote is permitted for the student to pass the oral examination. The major professor's/co-major professors' vote of approval is required for the student to pass the examination. If the Advisory Committee feels that the student has a particular area of weakness, he or she may be required to do additional coursework or directed reading in that area. In addition, the committee members may require that the student rewrite the dissertation proposal. For additional questions, please contact the Graduate Program Administrator.

Admission to Candidacy

The student must petition for admission to candidacy following successful completion of both parts of the examination. To do so requires submittal of the appropriate form, which will be provided to the student prior to the oral examination. Prior to applying for candidacy, students must provide the Graduate School with a final Doctoral Program of Study form. There is a two-semester residence requirement following admission to candidacy before the student can graduate. For additional questions, please contact the Graduate Program Administrator.

APPENDIX C:

Suitable Electives

***6000-level courses do not count toward Graduate School graduation requirements.**

Suitable Elective Courses for Graduate Programs

a) Bioinformatics courses:
   - BINF 6105-6105L Applied Cancer Bioinformatics – 2.0 credit hours
   - BINF 8140 Functional Genomics – 3.0 credit hours
   - BINF 8210 Computational Methods in Bioinformatics – 3.0 credit hours
   - BINF 8270L Composition, Organization, and Evolution of Genomes – 3.0 credit hours
   - BINF 8330 Macromolecular Simulations – 3.0 credit hours
   - BINF 8350-8350L Molecular Phylogenetics and Evolution – 3.0 credit hours
   - BINF 8940 Applied Genome Analysis – 3.0 credit hours
   - BINF 8980-8980D Case Studies in Systems Biology – 4.0 credit hours

b) Foundation courses for biologists:
   - STAT 6310 Statistical Analysis I – 3.0 credit hours
   - CSCI 7010 Computer Programming – 4.0 credit hours

c) Foundation courses for quantitative scientists:
   - BCMB 6000 General Biochemistry and Molecular Biology – 3.0 credit hours
   - BIOL 6040 Essential Biology for the Quantitative Scientists – 3.0 credit hours

d) Specialization in Applied Probability:
   - STAT 6510 Mathematical Statistics I – 3.0 credit hours
   - STAT 6520 Mathematical Statistics II – 3.0 credit hours
   - STAT 8700 Applied Stochastic Processes – 3.0 credit hours
   - STAT 8730 Sequential Analysis – 3.0 credit hours

e) Specialization in Computer Algorithms:
   - CSCI 6470 Algorithms – 4.0 credit hours
   - CSCI 8470 Advanced Algorithms – 4.0 credit hours
   - CSCI 8610 Topics in Theoretical Computer Science – 4.0 credit hours
   - CSCI 6140 Numerical Methods and Computing – 4.0 credit hours
   - CSCI 8140 Parallel Processing and Computational Science – 4.0 credit hours
   - CSCI 8150 Advanced Num. Methods and Sci. Comp. – 4.0 credit hours

f) Specialization in Database and Software Systems:
   - CSCI 6350 Global Information Systems – 4.0 credit hours
   - CSCI 6370 Database management – 4.0 credit hours
   - CSCI 6800 Human-Computer Interaction – 4.0 credit hours
   - CSCI 8350 Semantic Web – 4.0 credit hours
   - CSCI 8351 Semantic Web Servers and Processes – 4.0 credit hours
   - CSCI 8370 Advanced Database systems – 4.0 credit hours
   - CSCI 8380 Advanced Topics in Information Systems – 4.0 credit hours
   - CSCI 8820 Computer Vision and Pattern Recognition – 4.0 credit hours
   - CSCI 8950 Machine Learning – 4.0 credit hours

g) Specialization in Ecology:
   - ECOL (PBIO) 6580 Foundations of Ecology – 2.0 credit hours

ECOL 8310 Population Ecology – 4.0 credit hours
ECOL 8325-8325L Modeling Population Ecology – 4.0 credit hours
ECOL 8580-8580L Theory of Systems Ecology – 4.0 credit hours

h) Specialization in Genomic and Proteomics:
PBIO 6550 Bioinformatics Applications – 3.0 credit hours
BCMB 8140 Genomics and Bioinformatics – 3.0 credit hours
BCMB 8300 Advanced Proteomics – 3.0 credit hours
MIBO 8270-8270L Composition, Organization, and Evolution of Genomes – 3.0 credit hours
PBIO 6510 Genome Evolution Across the Tree of Life – 3.0 credit hours

i) Specialization in Microbiological Processes:
MIBO 6090 Prokaryotic Biology – 3.0 credit hours
MIBO 8110L Electronic Exploration of Prokaryotic Biology – 3.0 credit hours
MIBO 8600 Fundamental Processes of Prokaryotic Cell Biology – 3.0 credit hours
MIBO 8610 Prokaryotic Physiology and Diversity – 3.0 credit hours

j) Specializations in Microbiological Interactions:
MIBO 6220 Bacterial Pathogenesis – 3.0 credit hours
MIBO 6300 Environmental Microbiology and Biotechnology – 3.0 credit hours
MIBO 6500 Bacterial Symbioses – 3.0 credit hours
MIBO 8610 Prokaryotic Physiology and Diversity – 3.0 credit hours

k) Specialization in Plant Genomics:
PBIO 6510 Genome Evolution Across the Tree of Life – 3.0 credit hours
PBIO 6720-6720L Plant Variation and Evolution – 4.0 credit hours
PBIO 8100 Plant Genetics – 4.0 credit hours
PBIO 8111 Plant Development – 4.0 credit hours
GENE 8950 Molecular Evolution – 3.0 credit hours

l) Specialization in Statistical Genetics:
STAT 6320 Statistical Analysis II – 3.0 credit hours
STAT 6810 Probability Distributions – 3.0 credit hours
STAT 6820 Statistical Inference – 3.0 credit hours
STAT 8090 Statistical Analysis of Genetic Data – 3.0 credit hours

m) Specialization in Toxicology:
PHRM 6910 Introduction to Toxicology – 3.0 credit hours
BIOS 8100 Case Studies in Nonlinear Biostatistics – 3.0 credit hours
EHSC 8510 Environmental Risk Assessment and Communication – 3.0 credit hours
EHSC 8220-8220L PBPK Models – 4.0 credit hours

APPENDIX D:

Ph.D. Student Checklist

Coursework:

Core, all required:

☐ BINF 8211 ☐ STAT 8440 ☐ CSCI 6490

Biology Elective: Pick one

☐ _____ Course

Math/Stat Elective: Pick one

☐ STAT 6315 ☐ MATH 6780 ☐ Other_____ Course

Applied Bioinformatics Elective: Pick one

☐ BINF 8940 ☐BINF 8270L ☐BINF 8140 ☐BINF8980

☐Other_____ Course

General Elective: Pick at least two

☐ _____ Course ☐ _____ Course ☐ _____ Course

Other Required Courses

☐BINF 8060, each semester ☐ BINF 8061 each semester ☐ BINF 8900L or GRSC 8000

☐ BINF 8990 ☐ BINF 8970, lab meeting (if applicable) ☐BINF 9000 ☐ BINF 9300

☐GRSC 7770 (teaching assistants only)

Dates:

Begin at UGA:

Enter IOB Program:

Date of Written Exams:

Date of Oral Exam:

Admission to Candidacy:

Date of Notice to Graduate:

Date of Defense:

Required Forms – Ph.D.:

First Year:

☐ Advisory Committee form, end of second semester (May)

☐ Program of Study, preliminary (May)

Second Year:

☐ Advisory Committee Meeting form

☐ Program of Study, final (at least two weeks' prior to written exam)

☐ Notice of Exam-Written exam, to Graduate Program Administrator (December)

☐ Notice of Exam-Oral exam, to Graduate Program Administrator (three weeks' prior to oral exam)

☐ Report of the Written and Oral Comprehensive Examination form (upon completion of oral exam) Exam must be taken by end of second academic year.

☐ Application for Admission to Candidacy (upon completion of oral exam)

Third Year:

☐ Advisory Committee Meeting form

Fourth Year:

☐ Advisory Committee Meeting form

Final Semester:

☐ Application for Graduation-directly to Graduate School (check due date on Graduate School website)

☐ Notice of Exam-Dissertation Defense (three weeks' prior to the oral defense)

☐ Dissertation and Final Examination Approval (upon passing of dissertation defense)

☐ Electronic Thesis and Dissertation (ETD) Submission Form (upon passing of dissertation defense)

☐ Graduation Ceremony Information-directly to Graduate School

To view forms: http://grad.uga.edu/index.php/current-students/forms/

Forms are prepared and submitted by the Graduate Program Administrator, unless otherwise stated.

M.S. Student Checklist

Coursework:

Core, all required:

☐ BINF 8211 ☐ BINF 8940 ☐ STAT 8440 ☐ CSCI 6490

Other Required Courses

Thesis option:

☐BINF 8060, each semester ☐ BINF 8061 each semester ☐ BINF 8900L ☐ BINF 8990

☐ BINF 8970, lab meeting (if applicable) ☐BINF 7000 ☐ BINF 7300

Non-Thesis option:

Pick Three 8000-level courses:

☐ _____ Course ☐ _____ Course ☐ _____ Course

☐ Preparation of final technical report on a topic assigned by advisor

☐BINF 8060, each semester ☐ BINF 8061 each semester ☐ BINF 8990

Dates:

Begin at UGA:

Enter IOB Program:

Date of Notice to Graduate:

Date of Defense:

Required Forms: M.S.:

First Year:

☐ Advisory Committee form, end of second semester (May)

☐ Final Program of Study, second semester of residence, but no later than the Friday of the second full week of classes of the semester in which the student intends to graduate.

Second Year:

☐ Advisory Committee Meeting form

Final Semester: (Thesis option)

☐ Application for Graduation-directly to Graduate School (check due date on Graduate School website)

☐ Notice of Exam-Thesis Defense (three weeks' prior to the oral defense)

☐ Thesis Defense and Final Examination Approval (upon passing of thesis defense)

☐ Electronic Thesis and Dissertation (ETD) Submission Form (upon passing of dissertation defense)

☐ Graduation Ceremony Information-directly to Graduate School

To view forms: http://grad.uga.edu/index.php/current-students/forms/

Forms are prepared and submitted by the Graduate Program Administrator, unless otherwise stated.

Final Semester: (Non- thesis option)

☐ Application for Graduation-directly to Graduate School (check due date on Graduate School website)

☐ Graduation Ceremony Information-directly to Graduate School

To view forms: http://grad.uga.edu/index.php/current-students/forms/

Forms are prepared and submitted by the Graduate Program Administrator, unless otherwise stated.