Handbook for the
Genetics, Genomics &
Bioinformatics M.S. Graduate
Program (GGB)
GUIDELINES FOR M.S.DEGREE STUDIES IN THE GENETICS, GENOMICS & BIOINFORMATICS PROGRAM

Revised Dec., 2017

I. Preamble

This handbook provide graduate students, program faculty, the GGB Steering Committee and the Program Director with a description of the program and policies for M.S. graduate study in the Genetics, Genomics & Bioinformatics program.

II. The GGB Steering Committee (GSC)

The GGB Steering Committee (GSC), chaired by the Director and consisting of at least three other faculty members will be responsible for administering all facets of the graduate program. The Director is appointed by the Dean and the other members of the Committee are voted on by the program faculty.

III. Admission Requirements

A Bachelor of Arts or Science is required. A background in genetics, other areas of biology or mathematics or computer science is typically required for admission. Master’s candidates will be admitted directly through the GSC and will in general need to identify a specific faculty mentor prior to admission to the program.

IV. Training Program for the M.S. Degree

The graduate program in Genetics, Genomics and Bioinformatics is based on the principle that the most effective curriculum is one that emphasizes self-study, in-depth discussions and problem solving.

The first year curriculum follows much of the PPBS program. This includes one-semester of fall courses in the Principles of Biochemistry, Cell Biology, and the Essentials of Genetics and Genomics. In spring of year 1 the students will take Introduction to Bioinformatics and Computational Biology as a GGB required course. Other required and elective course are described below. The training program provides a variety of research-related experiences for the graduate student which includes a Program seminar program of visiting scientists and a Presentation Seminar course. The Presentation Seminar provides experience not only in reading, evaluating and presenting current research papers but also in oral presentation of scientific work. All students are required to attend Program seminars regularly throughout their training.

During their first or second semesters, students will be assisted in developing an original research proposal, which they will defend before their Research Advisory Committee (RAC). Preparing an original research proposal provides an opportunity to apply and sharpen a combination of the skills acquired throughout the first year of the program. This program is designed to prepare students for their research work and for the continual learning process of a career in science. The largest part of developing into a productive research scientist occurs during the research for the thesis or project.

V. Student Classification

A. Matriculating Students

Matriculating students pursue a course of study that will lead to a M.S degree. Students are admitted through direct application to the program via UB GradMit. The M.S. degree requires a minimum of 30 credit hours. Matriculating students are divided into two categories: full-time students and part-time students. Parttime students are full-standing students who would ordinarily be accepted into full-time study, but because of circumstances, e.g. holding a job, wish to study part time.
B. Non-matriculating Students

This status is reserved for students who are not seeking a degree at this university but wish to take Genetics, Genomics and Bioinformatics courses. Such individuals should provide evidence of meeting course prerequisites. The non-matriculating student status is granted for a one-year period, but may be renewed. A non-matriculating student who wants to enter a degree program, must have a complete application for matriculation considered by the GSC. Transfer of credits obtained during non-matriculating status to a matriculating degree program is not automatic, but may be granted upon review by the GSC.

VI. Student Advisors

During the first semester, students are normally advised on academic matters by the Administrator of the GGB program and can also ask the Program director or GGB Steering committee members for advice. Students are strongly encouraged to consult with GGB faculty, to determine those who may become thesis/project mentor, before they begin classes. In their 1st semester, students will choose their research advisor/mentor. Students are expected to start working in their mentor’s laboratory as soon as it is chosen.

The Research Advisory Committee for the student is chaired by the mentor and consists of a minimum of three graduate faculty (including the mentor), two of whom must have an appointment in the Genetics, Genomics and Bioinformatics program. The mentor must have an appointment in the Program. A non-tenure track faculty member may serve as a committee member if he/she is a member of the graduate faculty. Additional graduate faculty members may be appointed upon agreement between the student and their mentor, usually with the goal of bringing some special expertise into the committee. One member of the GSC is a full or ex officio member of all Research Advisory committees. Beginning in the student’s first semester in the M.S. Program in Genetics, Genomics and Bioinformatics, the student will register for 1-12 hours of GGB 701, Research. The student will report to the Research Advisory committee on the progress of her/his research, and outline plans for the year. Students are required to meet with the Research Advisory committee at least once each year. Students are required to submit Research Advisory committee Report forms following each meeting.

VII. Course Requirements for the M.S. Degree

The M.S. degree requires a minimum of 30 credit hours. Required courses are the PPBS first year courses (with the possible replacement of BMS 503 by BCH 503) and BCH/GGB 519-Bioinformatics and Computational Biology (3 credits). In addition the student will take at least two of the following courses:

BCH/GGB 512 - Developmental Genomics & Stem Cell Biology (2 credits); EEH 674 Fundamentals of Genetic Epidemiology (3 credits); GGB 611 - Microbial Genetics (2 credits); GGB 505 - Human and Medical Genetics (3 credits); BIO 450/550 – Human Evolutionary Genomics (3 credits); BCH/MIC 406/506 Composition and Function of the Human Microbiome (2 credits); BCH/MIC 607 – DNA Replication and Repair (2 credits); PHC 509 – Pharmacogenomics in the Pharmaceutical Sciences (2 credits). In addition, the degree requires GGB 607 - Presentation Seminar (1-2 x 1 credit); one or two electives or Special Topics courses (~6 credits) and a minimum of 4 credit hours of research. The student must achieve a GPA of 3.0 and a B or better in every required course.

Two important time points:

1) Each student must meet with their Research Advisory Committee members in the Spring Semester of year 1 or earlier in the program for approval of their thesis/project topic. The nature of this meeting and written document are discussed below.
2) Another meeting must be scheduled in the Spring semester of year 2 of the program to defend their thesis/project. The meeting dates should be set by the student in consultation with their mentor and their
research committee. The expectations for the committee meeting are described in section IX D. Research Progress Report.

The following is a proposed curriculum for M.S. students. Credits can be reduced to as little as 1 credit/semester after application to candidacy (ATC) having fulfilled all coursework required for the degree. While this is the recommended order of courses the timing can be modified if needed as long as all courses are completed prior to completion of the degree.

VIII. Typical course schedule for the M.S. Degree

Typical GGB M.S. student FIRST YEAR CURRICULUM - FALL SEMESTER

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMS/GGB 502</td>
<td>Essentials of Genetics and Genomics</td>
<td>3</td>
</tr>
<tr>
<td>BMS 503</td>
<td>Principles of Biochemistry</td>
<td>4</td>
</tr>
<tr>
<td>Or BCH 403/503</td>
<td>Biochemical Principals</td>
<td>4</td>
</tr>
<tr>
<td>BMS 501</td>
<td>Cell Biology</td>
<td>4</td>
</tr>
<tr>
<td>GGB 701</td>
<td>Research</td>
<td>1-3</td>
</tr>
</tbody>
</table>

TOTAL CREDITS 12-14

Typical GGB M.S. student FIRST YEAR CURRICULUM - SPRING SEMESTER

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCH 519</td>
<td>Introduction to Bioinformatics &amp; Computational Biology</td>
<td>3</td>
</tr>
<tr>
<td>Varied</td>
<td>Electives (1-2) see GGB or other graduate curricula for current selections</td>
<td>2-6</td>
</tr>
<tr>
<td>GGB 701</td>
<td>Research</td>
<td>1-4</td>
</tr>
</tbody>
</table>

TOTAL CREDITS 12-14

Students will meet with their research advisory committee in the spring semester of Year 1 for approval of their thesis/project or project topic.

Typical CURRICULUM BEYOND THE FIRST YEAR

*TWO OF THE FOLLOWING (some requirements may be fulfilled in second semester above):

*GGB/MIC 611 Microbial Genetics 2
*GGB 505 Human And Medical Genetics 3
*BCH/GGB 512 Developmental Genomics & Stem Cell Biology 2
*BIO 450/550 Human Evolutionary Genomics 3
*BCH/MIC 406/506 Composition and Function of the Human Microbiome 2
500/600 Level Special Topics/Electives As required to fulfill 30 credit requirement. 

Computer Science, Biostatistics, Neuroscience, Microbiology, Biology or other courses (Can also be fulfilled by additional GGB courses above)

These courses introduce students to the concepts, principles and practice of modern biomedical sciences. Topics covered include the following: Genetics, Genomics, Bioinformatics, Evolutionary Genomics, molecular biology, principles and practices used in computational analysis of DNA and protein sequences, Developmental Genomics, human genetics and other topics.

These courses will progressively deliver selected material in depth and equip students for experimental science by introducing them to the critical use of the literature. The later courses will be oriented towards problem solving. Where appropriate, the emphasis will be placed on reading and discussing the primary literature, both historical and current, i.e. in-class discussion of outside reading. Evaluation of students’ performance may include in-class written quizzes or oral exams and midterm and/or final exams. These are advanced courses in the 500 and 600 level in specialized areas of Genetics, Genomics and Bioinformatics. The format of each depends on the subject and the instructor. Up-to-date descriptions can be obtained from the course catalog or the SMBS website. Special Topics and Electives may be taken at any time but a minimum of 2 courses and 6 credit hours are required before a student may graduate. The electives may be selected from courses taught outside of the program, subject to the approval of the GSC. The Special Topics requirement can be fulfilled by achieving a grade of B (not B minus) or better. A student cannot take a course addressing the same material more than once to fulfill the requirement. Students should discuss the most appropriate courses to fulfill their elective requirements with their Mentor prior to registering.

M.S. thesis/project presentation (Year 1, 1st or 2nd semester).

For their first committee meeting the student will prepare, in consultation with their mentor, a 3-5 page written description of their proposed thesis/project. It will have a Title, a 1-2 page introduction to the topic that includes data that support the reason for the project, 1-3 specific aims for the thesis/project (1-2 pages each) and a brief expected outcomes section 1-2 pages. The student will distribute this document to their committee members at least 1 week prior to the 1st committee meeting. The student will be expected to defend this document to their committee as described below in section. IXD. Research Progress Report.

Selection of Research Mentors

Selection of the Mentor is one of the most important decisions a student will make. The decision should be a careful and deliberate one. The choice of the Mentor must be approved by the GGB Program Director. This selection should be made in the 1st semester of Year 1.

Public Presentation of Research

Part of M.S. student training and experience is oral presentation of primary research in a public format. Presentation skills are critical to success in science and our effort to provide assistance in acquiring those skills has three components as described below.
Course Registration and Course Credit Requirements
GGB 607 –Presentation Seminar (1 credit course). Students are required to register for GGB 607 after their first year in the Master’s program in Genetics, Genomics and Bioinformatics.

GGB 607 Requirements: Student attendance at GGB 607 presentation is required. Active participation in the form of comments and questions is an essential aspect of this and all Program-sponsored presentations (Student, Program, and Distinguished Scientist Seminars) and is strongly encouraged.

Students will be given an S grade based on presentation (presenting students) and attendance (all students). Evaluation and critique of the presentation will be the responsibility of the student’s Research Advisory committee; comments from the audience are also recorded on Evaluation Forms available at all student oral presentations.

IX. Programmatic Components of Training in Oral Presentation A.
Overview
1) First Year Students. Students in their first year in the Program as Master’s students prepare the research proposal presentation. The Proposal process is initiated with a presentation by the student of the background, specific aims and research plan that outlines the Master’s thesis/project proposal itself. This presentation is given in the Presentation Seminar (GGB 607) in the Spring of First Year.

2) Second Year Students. Students in their second year in the Department as M.S. students give an oral presentation of their research project, given in the Presentation Seminar 607 course in the Spring of Second Year.

B. Genetics, Genomics and Bioinformatics Department Research Day.
Students in their first year in the Program are expected to come to Research Day and present a poster of their proposed research if available. Students in their second year in the Program are expected to give either a poster or oral presentation.

C. Presentation Seminar - GGB 607
Monitoring this course is the responsibility of the GGB Steering Committee. The objective of the Presentation Seminar is to provide a mechanism for students to gain experience and expertise in preparing and presenting orally a Research/Teaching Seminar. There are two vehicles for doing so: 1) the Thesis/project proposal Presentation (GGB 607) and 2) Thesis/project Research-In-Progress seminar. The first of these is described in GGB 607. The last of these is to follow the format of a research seminar: Introduction and Background, Research Plan and Experimental Design; Results and Discussion; Summary and Conclusions.

Student presentations in the Presentation Seminar will be reviewed by the GSC and or RAC. The Committees will prepare the appropriate Evaluation forms to be placed in the students’ graduate document files.

D. Research Progress Report - GGB 702
The student’s Research Advisory Committee will meet at least once yearly (or more often at the discretion of the student/mentor, and/or committee). The Research Progress Report meeting is designed to assess: 1) the progress that the student has made in their intellectual and scientific development, 2) the progress that the student has made towards the work that will be included in their Thesis/project, 3) any coursework completed since the last committee meeting and 4) any public presentations or publications by the student. It will test the student on their thought processes and the rigor of their logical reasoning, as well as the practical aspects of their experimental work. The student will prepare a 30-40 minute presentation
of the work that they've done, presenting it in the format: hypothesis/project being tested, experimental approach and procedures, results, conclusions, implications for future studies. The student should expect to be interrupted by the committee during this presentation with questions of the type: "Why is this important to know?, What is the evidence for that?, Are there alternative interpretations of your data?" etc. The student should be expert in all of the techniques that they use in their studies and should be expected to answer questions about how the experiments were designed, the proper controls for each experiment, and the alternative interpretations of results from the experiments. They should be prepared to defend each experiment performed. It will NOT be just a list of experiments done, although that may be part of it. Ideally, the committee and student will work together to generate alternative interpretations, clearer experiments and a working model of the system being analyzed that the student can further test. Over several such meetings, the student will become so clear, precise and facile at describing the system they have studied, what they have learned about it, and what they have yet to learn about it, that they will show that it is time for them to write and defend their thesis/project. At this stage they'll proceed to writing their Thesis/project report.

The report on the status of the student thesis/project report form must be completed after each Research Advisory committee meeting, and a signed copy put in the student’s departmental office file. This form will be completed by the thesis/project advisor and reviewed and signed by the student, the advisor and all committee members present. Research Advisory Committee reports will be copied to all committee members. This written report must be submitted before a grade can be filed for GGB 702. Any Incomplete (I) grades in GGB 702 arising from failure to have a Research Advisory committee meeting must be removed no later than the start of the next (Spring) semester.

At the first meeting of the Research Advisory committee (in the student’s second semester) the student presents the abstract of her/his thesis/project research. Once reviewed and approved by the Committee, this abstract then becomes part of the student’s Application to Candidacy for the Degree Masters in Genetics, Genomics and Bioinformatics. This Application must be completed and submitted by the student at or before the beginning of the student’s fifth semester in the University.

X. Standards for the M.S. Program
Grading in Courses -
GGB 607 and 701 will receive S or U grades. GGB 502, 611, 505, 512, 519, BMS 501, 503, and any other Special Topics and electives will receive letter grades. GGB 701 can be graded as either S/U or A-F depending on the mentors preference.

Academic Standing - The conditions for dismissal from the M.S. program are as follows: failure to achieve an overall B average in the first year; two or more B- or lower grades among the other required courses (failure to achieve a grade of B or better upon repeating the course will be cause for dismissal); failure to earn an S grade in the Research Proposal within 12 weeks of the Presentation Seminar presentation; or receipt of two consecutive U grades in Presentation Seminar presentations. An overall GPA of 3.0 in required course work applied towards a graduate degree is required by the graduate school. A GPA of less than 3.0 will be cause for dismissal.

XI. Financial Aid
Master’s and part time students: The program does not offer Master’s or part time students a tuition scholarship or a teaching Assistantship and stipend. However, the research advisor has the discretion to provide support if funds are available.
XII. Filing for M.S. Candidacy

**M.S. Students** who will meet the course requirements for the M.S. degree in Genetics, Genomics and Bioinformatics must file their application to candidacy during the semester in which these requirements will be fulfilled (at least Spring of their 2nd year). Students in Genetics, Genomics and Bioinformatics will use the traditional ATC form that includes an abstract and all Program signatures. The ATC will be prepared by the student in consultation with her/his mentor, and submitted and reviewed by the Program Administrator.

XIII. M.S. Thesis/Project Defense (Year 2, 2nd semester)

The M.S. Thesis Defense will consist of a presentation by the candidate. First, the written thesis/project will be reviewed by the mentor and Research Advisory committee. With the written approval of all members of the Research Advisory committee, the student will ask the Program Administrator to schedule an Oral Presentation of the Thesis/project to be held with the Research Advisory committee. Successful completion of the defense presentation will constitute a successful defense of the M.S. Thesis as indicated by the completion of the Graduate School M Form. The student will then give a Presentation Seminar on their thesis/project work.

The time-table for M.S. Thesis review is given below based on the following two considerations: 1) the Research Advisory committee members must have at least 3 weeks to review the thesis/project and approve it for Oral Presentation and 2) at least one week must separate the Oral Presentation from the Thesis/project Presentation Seminar.

The Thesis, as approved by the student’s mentor, must be received by the Research Advisory Committee members no later than 3 weeks prior to the projected date for the GGB program Thesis/project Seminar. This Thesis/project Draft must be in full compliance with the format required by the Graduate School.

The Presentation to the Research Advisory committee must be held a minimum of 1 week prior to the projected date for the Departmental Thesis/project Seminar.

There are two administrative additions to the Master’s Thesis/project Review as follows:

1) Progress towards a successful Defense of Thesis/project will be monitored by the GSC.

2) The standard Thesis Research Presentation form will be used by the Research Advisory committee to note approval of the Oral Presentation.

The M.S. Project defense is a simpler procedure and involves the Mentor approving of a written project by the student. Upon acceptance of the project by the Mentor the student then completes the M form for submission to the graduate school.

XIV. Subsequent admission into the GGB Ph.D. program

GGB M.S. students who decide during their 1st or 2nd year to apply for a transition into the Ph.D. program must complete the same Dissertation Proposal (GGB 606) requirement as GGB Ph.D. students who come through the PPBS portal. They must also successfully complete BMS503 if it had not been taken.

XV. Student Participation in Program Activities

1. Students are expected to participate actively in the evaluation of candidates for faculty positions. In addition to attending the candidates’ seminars, the students meet with prospective faculty members to discuss their research and ideas concerning graduate training. Written evaluations solicited from students are useful to the search committees in assessing teaching abilities, communication skills and interpersonal skills.
2. Graduate students meet with applicants to our graduate program who visit the department to discuss the graduate program and life in Buffalo.

3. Input from graduate students on other issues of the graduate program is encouraged and may be given to the Program Director, a member of the GSC, or any Program Faculty.

4. The faculty feel that it is important that graduate students have opportunities to present their thesis/project work on an ongoing basis and in an internal forum other than the thesis/project defense. Therefore, each student in year 2 of the program will present his/her research during the annual program research day/retreat. This research day will take place in Winter interlude.

5. Senior students will be assigned roles as Moderators of Presentation Seminar (GGB 607). This assignment will be made by the Program Director and all students are expected to fulfill this role at least once.

6. The GGB GSA club will allow students to interact on a less formal basis, share common interests, plan events, etc.

XVI. Student Leave Policies
1. Vacation Leave
   In regards to vacation leave, the period chosen should result from discussion between the student and mentor and should be consistent with the educational and research commitments associated with the student’s academic and research objectives and responsibilities. Students shall also be allowed reasonable medical absences for sickness or treatment. Time spent fulfilling Departmental or Medical School assignments or responsibilities are not considered vacation or leave time (e.g., assisting in courses, student mentoring and recruitment, organizing research day).

   Two principles shall be followed by the student and mentor in discussing leave time: 1) the student and mentor have made a mutual commitment to training and research objectives; and 2) achieving these mutually reinforcing objectives requires flexibility in effort and time-of-effort. Although the mentor cannot forcibly deny a leave request, she or he can certainly view such a request as inconsistent with the student’s commitment to these training and/or research objectives. If disagreements arise which student and mentor are unable to resolve, the Department Head and Program Director should be informed by either the student or mentor or both and an effort will be made to mediate the dispute.

2. Maternity Leave
   Students requesting maternity or paternity leave will be granted up to 8 weeks continuous absence during which registration will be continued. A more prolonged leave may be negotiated by mutual consent of student and advisor.

XVII. Petitions
   Petitions must be submitted to the Program Director and/or the Graduate School (and approved by the Divisional Committee in the latter case) for the following purposes:

A. Extension of time limit for completion of degree. Students must submit a petition listing justifying reasons for an extension beyond two years for completion of the M.S. degree.
B. Leave of absence. If a student wishes to take a leave of absence a petition must be submitted detailing the reasons for the leave.

C. Change of status. A petition to change status from M.S. to Ph.D. must be submitted in the form of a letter to the Program Director. A copy of this letter and the approval must accompany the student’s program form when it is submitted to the Graduate School. A petition for a switch from the M.S. to the Ph.D. program must be subject to the admissions process.

D. Change of Thesis/project Advisor. The same procedure for a letter is followed as in C, above.

E. Course requirements. If a student requests that an exception be made to the normal course requirements, the same procedure is followed as in D, above.

XVIII. Grievance Procedure

Students should feel free to contact the Program Director on personal and academic matters or with grievances. On matters under Program jurisdiction in which a student believes he/she has been aggrieved, a formal grievance review may be requested. The request must be in writing from the student concerned to the Program Director (or to another member of the GSC if the grievance involves the Program Director) and must be filed within one month of the alleged grievance. It must clearly state the charge of grievance, its effects, and summarize the particulars concerning it. The Program Director (or other GSC member), in consultation with the concerned parties, will appoint an *ad hoc* committee with student representation to investigate the grievance. The *ad hoc* committee’s action is restricted to procedures or administrative matters, as opposed to judgments of academic performance. All hearings of the Grievance Committee will be closed. No formal minutes will be taken. The committee will report its recommendation for resolution of the grievance within one week after filing. Grievance reviews for graduate students are also available through the Graduate School.

Acknowledgements:

Special thanks to Beth O’Brocta and the Graduate Affairs Committee of the Department of Biochemistry who provided the initial template for these guidelines.