Biology & Biomedical Sciences

ACADEMIC PROGRAM GUIDELINES

Program in

Human and Statistical Genetics
Guidelines for Ph.D. Students

Human and Statistical Genetics Graduate Program

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1. Introduction & Overview

The primary objective of the Human and Statistical Genetics Program is to train Ph.D. students in human genetics and biostatistics so that they can competently and effectively participate in interdisciplinary team research on cutting edge biomedical problems. Since we are into the post-genomic era of “genetic medicine”, the program is designed around human genetics, statistical genetics, and computational sciences including bioinformatics. Training will be in molecular biology and human genetics as well as in statistical and methodological areas, with greater emphasis on hands-on learning than pure didactic course work. Every Ph.D. student will be required to undertake hands-on lab rotations in both biological “wet” labs as well as in statistical “dry” labs so that they will not feel intimidated by unfamiliar biological problems. This will produce well-rounded future quantitative biomedical scientists.

The Program integrates “Human genetics” and “Statistical genetics” both at the level of didactic course work as well as in the research laboratories. However, to ensure that each student in HSG has a minimum mastery in both areas, lab rotations are required in both areas (“wet” lab rotations in human genetics and “dry” lab rotations in statistical genetics). Mentors chosen are experts in the field of specialization. Because of the dual nature of the program, a co-mentor from the other discipline can sometimes be an advantage for students whose research requires oversight and advice in both disciplines. These guidelines have been compiled to assist students in making informed educational choices and to aid the faculty in advising them.

The Program expects every student to satisfy three requirements before beginning a thesis project: The first requirement is to master the basics of human and statistical genetics, as demonstrated by satisfactory completion of the core courses in the Program; The second requirement is to demonstrate competence in laboratory rotations; The third requirement is to demonstrate intellectual skills in analysis and synthesis, by passing the Qualifying Examination. Finally, these guidelines evolve in response to specific opportunities and/or needs and, therefore, students and faculty should monitor them periodically.
2. **Advising**

Timely and good advice is often can be very important for to graduate students. Students should take advantage of advice from a number of sources, both informally from faculty and students and more formally from appointed advisors that meet with the student at appropriate intervals.

**Student Mentors**

- Each first-year student is assigned a student from the second- or third-year class to act as mentor. The student mentor may serve as a first source for answers to many questions but also may encourage the student to meet with a faculty advisor where appropriate.

**Faculty Advising**

- The Program Co-Directors will advise first-year and second-year students. Twice a year, each student will meet individually with the Co-Directors. At that time they will discuss the selection of appropriate coursework is discussed, and issues related to laboratory rotations/thesis labs.

- Once a student has completed a thesis proposal, advising will no longer be required, since the thesis committee takes this responsibility over. However, students should feel free to consult their previously assigned advisers.

- The Co-Directors will also meet with any student who has not yet completed a thesis proposal or is in the fifth year or beyond.

3. **Coursework & Program Requirements**

**Core Courses**

There are four core courses required of all students in the program. Individual core courses may be waived, subject to approval by the Steering Committee and the course master, based on substantially similar coursework completed previously.

**“Core” Courses (all four are required of all students in the program):** To meet the requirements of the program, each student must receive a minimum grade of “B-” in all the required core courses.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>L41 Bio 5285</td>
<td>Fundamentals of Mammalian Genetics (3.0)</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>M21 GEMS-5483</td>
<td>Human Linkage and association (3.0)</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>M21 GEMS-621</td>
<td>Computational Statistical Genetics (3.0)</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>L41 Bio 5011</td>
<td>Research Ethics (1.0)</td>
<td></td>
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</tbody>
</table>

**Elective Courses**

All students are generally expected to take a minimum of 9 and a maximum of 12 credits of electives with the understanding that they have completed all of their requirements (including advanced electives) by the end of their third year (electives taken in Medical School will be applied to MSTP students, so the elective requirement will be waived unless otherwise determined by the Program Directors). If special circumstances arise with thesis work which may require additional
skills or coursework, the program coordinator should be contacted following the approval of the 
mentor and both Program Directors regarding taking additional coursework.

The current list of approved electives are presented below. However, students are also encouraged to 
bring any electives that would enrich their particular thesis work to the attention of the Program 
Directors for consideration.

Electives from the following list (min of 9 and max of 12 credits) (**recommended ones are in bold**)

**FALL Courses**
- L41 Bio 4181  Population Genetics
- L41 Bio 5068  Fundamentals of Molecular Cell Biology
- L41 Bio 548  Nucleic Acids and Protein Synthesis
- L41 Bio 5495  Computational Mol Biology
- L24 MATH 493  Probability
- L24 MATH 5061  Theory of Statistics

**SPRING Courses**
- L41 Bio 5284  Current Research in Chromatin, Epigenetics and Nuclear Organization
- L41 Bio 5488  Genomics
- **L41 Bio 5491  Advanced Genetics**
- L24 MATH 494  Statistics
- L24 MATH 495  Stochastic Processes
- L24 MATH 5062  Theory of statistics II

**SUMMER Course**
- M21 GEMS 550  Introduction to Bioinformatics

- Since the emphasis of this program is on “multidisciplinary” approaches, there is a greater need to 
distribute the electives among the component disciplines according to individual student’s needs, 
identified areas of deficiency, and identified area of specialization. These decisions will be made 
in consultation with the Program Directors.

- Students are expected to obtain at least a “B-” for the elective courses they select. Students earning 
grades lower than B- will need to take the course again so that they can master the material.

- The Graduate School requires that all students maintain a "B" average (3.0 cumulative GPA).
Journal Clubs

- Students are **required** to attend (and present at least once per year) the Journal Club offered by the Division of Human Genetics each semester during the first 2 years.
- All current upper level students are encouraged to attend the journal club.
- Additional opportunities are also available including those listed below.

**Journal Clubs/Seminars:**
- Genetics Department seminars
- Division of Biostatistics seminars
- L41 Bio 5235  Genetics Journal Club
- L41 Bio 5416  Molecular Microbiology & Pathogenesis Journal Club
- L41 Bio 5443  Nucleic Acids & Nucleic Acid Protein Interactions Journal Club
- L41 Bio 5481  Student Run Molecular Genetics Journal Club
- L41 Bio 5496  Seminar in Computational Molecular Biology Journal Club
- L41 Bio 5489  Human Genetics Journal Club
- Division of Statistical Genomics, Methods Forum

*Any deficiencies can be remedy with additional coursework as recommended by the program.

Lab Rotations

The purpose of the lab rotation is to broaden the student's research experience and to expose the student to available opportunities before a thesis preceptor and problem are selected.

The major goal of the HSG program is to train students with a cross-cultural training in “wet lab” molecular biology and human genetics as well as in “dry lab” analytical and computational techniques of genetic epidemiology and statistical genetics. Graduates of the program will understand the critical issues in both fields and will be able to employ both fields in addressing and answering problems in biomedical research.

- Therefore, to achieve true integration, each student is required to do three rotations, with each one typically lasting 10-12 weeks.
- All lab rotations are expected to be completed during the first year (including summers). It is required that each student will have selected a thesis lab by *June 1st* of the first year (Fall semester of first year for MSTP). Program Directors are available for consultation regarding laboratory rotations. Prior to the start of the rotation the students will complete the Research Rotation Form [http://dbbs.wustl.edu/curstudents/StudentForms/Pages/StudentForms.aspx](http://dbbs.wustl.edu/curstudents/StudentForms/Pages/StudentForms.aspx) which will be signed by the student, research mentor and a Program Director.
- The Program Coordinator should be notified when laboratory rotations are selected.
- Upon completion of a lab rotation, students will file a rotation report with the Program Coordinator who will share it with the Program Directors.
It should be recognized by both student and rotation mentor that significant research accomplishment is not a requirement for a successful rotation, nor should the rotation be prolonged significantly beyond the normal three-month period to meet particular research objectives. Students may choose to end a rotation at any time, should they find it desirable to move on to the next rotation as long as they discuss this with the Program Directors.

During the rotation, the student should take advantage of the one-on-one relationship with the faculty member to discuss science as it is carried out in the lab, and to evaluate together the approach to research. Students should explore these contacts carefully during rotations, mindful that selection of a good mentor who will provide the personal instruction required to master experimental science is the most important decision they will make in graduate school.

**Teaching Requirement**

Effective communication of information and concepts is a critical skill for biomedical research scientists. While much of the teaching that scientists engage in is through one-on-one interactions with individuals in the laboratory, all scientists must be able to deliver lectures to a wide audience (from peers in the field to neophytes with a limited understanding of the nuances of the topic), and scientists in faculty positions will often teach courses to undergraduate and graduate students. Therefore, DBBS students must demonstrate the ability to effectively communicate complex ideas and concepts to groups of individuals at various levels of understanding. To develop these critical communication skills, DBBS students will:

- Complete the TA orientation and three approved workshops offered by the Teaching Center by the end of the 2nd year of graduate studies
- Serve as a Teaching Assistant in a DBBS-approved graduate or undergraduate course for 1 or 2 semesters. The TA assignment will include giving lectures and/or leading lab sessions. The TA is usually completed in the 2nd year of graduate studies.
- Deliver a minimum of four oral presentations at journal clubs, seminars, scientific conferences, and retreats. Presentations given as part of a TA assignment, lab meetings or thesis committee meetings will not satisfy this requirement.

**Summary of Time Lines:** All important time lines are summarized below:

Required Cores and Electives should be completed by the end of the first two years. Any additional courses will be spaced out and taken throughout, to facilitate the student’s activities.

Students who have completed the Genetic Epidemiology Master’s (GEMS) Program should be able to complete the Fundamentals of Mammalian Genetics and all necessary electives during the first year, leaving only the Ethics course and Teaching Assistantship for the second year.

- All Core courses and Electives must be completed by the end of the second year (advanced electives may continue until the end of the 3rd year)
- All Lab rotations should be completed in one year (even exceptions may not take more than one and half years)
- Selection of a thesis lab is expected by **September 1** of the 2nd year (Fall of the first year for MSTP)
Φ TA (usually) during the 2\textsuperscript{nd} year (first year for MSTP)
Φ Qualifying Exam must be completed by the end of the second year, June 30\textsuperscript{th}. (end of the first year for MSTP)
Φ Thesis research proposal must be completed (ideally) by the end of the second year but no later than the end of the 5\textsuperscript{th} semester (by December 31 of second year for MSTP)
Φ Thesis defense expected sometime in the 5\textsuperscript{th} year (third year for MSTP)

4. \textit{Qualifying Examinations}

- All graduate students in the HSG Program are required to complete the Qualifying Examination (QE) by the end of their second year (first year for MSTP).
  - The QE will consist of an oral presentation by the student on three peer reviewed publications from the field of human/mammalian genetics and statistical genetics.
  - The publications will be selected by the student, and must focus on a single theme (e.g. a disease, a technology) and be approved by the program directors. This can be done by the student emailing pdfs of the publications to both directors for their approval.
  - At least one publication must be on the “wet/biological” lab component and at least one must represent the “dry/analytical/statistical” lab component, although greater level of background and expertise are expected within one’s own chosen area (wet or dry lab).

- The student will notify the Program Directors when he or she is ready to take the QE. The student should email publications along with topic to the Program Directors for approval. The student will also provide a suggested list of 3-4 committee members to the Program Directors.
  - The Program Directors will determine if the topic is appropriate and will also approve committee members from the list provided by the student. The Program Directors may make recommendations of committee members. Once, members are selected the Program Directors will name the Chair of the student’s Qualifying Examination Committee.
  - Students will be notified by e-mail when the membership of her/his exam committee has been confirmed. The Program Coordinator will notify the student with the committee.
  - The student will work with their committee to schedule the time/date/location of the exam. Examinations will typically take one to two hours. Clearly, oral presentation style is important and will be evaluated.
  - After the oral examination, the Committee will discuss the performance of the student and decide if (s)he met the requirements needed to pass – there may or may not be a written critique.

5. \textit{Consequences of Failing the Qualifying Examination}

Every student who fails the QE will be given an opportunity to take a second qualifying exam within 6 months, unless other actions are suggested by the overall Qualifying Examination Committee or the Steering Committee.

For the retake of the exam, the student may select the same general topic area or a different one; if the same general area is selected as that of the first exam, the specific topic selected and the individual
exam committee must be entirely different. The second exam committee will also be set up the same way as the first one. In addition, one member of the original individual exam committee (selected by the overall Qualifying Exam Committee Chairs) will be invited as an observer; this individual will not, however, participate in either the examination or the evaluation of the student's performance. The revised examination should ordinarily be completed within one to two months after the first exam (and within 6 months otherwise). If the deficiencies have been corrected, the student will pass (and the qualifying examination requirements will be met). If the deficiencies have not been corrected, the student will be considered to have failed the qualifying examination. A student unable to pass the exam on the second attempt may be dismissed from the program and the DBBS.

For the re-take of the QE, the Qualifying Exam Committee may approve a conditional pass, subject to the student performing a certain task (such as, for example, taking a certain course and passing with a specified grade or better), in which case the task will be clearly stated in writing. The time line will then be dictated by the task to be done.

If a graduate student who has failed the Qualifying Examination twice feels that the decision to fail him/her was made incorrectly or inappropriately, the student may appeal the decision to the Program Steering Committee. The appeal must be made in writing and must state explicitly the reason(s) that the student believes the failing was incorrect or inappropriate. The Steering Committee will review the appeal and, if the student is agreeable, may invite the student to meet with the Steering Committee to discuss the appeal. The Steering Committee may (but is not required to) consult with the individual exam committee members directly as part of their deliberations. The Steering Committee will vote to either uphold the exam committee's decision (and the student will not be allowed to continue in the program) or allow the student to retake the examination again for the third time. In the latter case, the procedures for retaking a Qualifying Examination detailed above will be followed. If the student feels that the action of the Steering Committee is incorrect due to a procedural flaw in the examination process, the student may submit a written petition to the Chair of the Programs and Student Affairs Committee and, if warranted, the PSA Committee will hear that appeal.


Thesis Committee Composition

The mentor should be a tenured or tenure track faculty member. A thesis lab should be chosen in consultation with the Program Directors after completing at least 3 rotations, and a Thesis Committee should be formed within 4-6 months thereafter. The Thesis Committee, which must be approved by both program directors, shall consist of a total of 6 faculty members, including the student's research advisor (mentor); five of the six faculty members must be tenured or on the tenure track; four of the six faculty should be DBBS members; and at least 2 members must be affiliated with the HSG program. Two of the 6 faculty could be from any of the other programs, or Wash U departments outside the DBBS. Both areas of specialty (human genetics and statistical genetics) must be represented by at least one faculty member on each Thesis Committee. In certain cases it may be desirable to invite experts from outside the University to participate in the Committee. In that situation, it is the responsibility of the student and the student's advisor to identify sources of funds which could be used to pay for the outside examiner's expenses and to obtain the approval of the Program Director and the Dean of the Graduate School of Arts & Sciences prior to extending the invitation to such an examiner.

A quorum of four members including the thesis advisor is needed for any pre-defense meeting. The
student and mentor nominate these committee members subject to approval by the Program Directors. The committee members are selected for their expertise in areas related to the student’s research, and for their willingness to contribute advice and meet at least once per year. The committee is chaired by a faculty member other than the thesis mentor, and the chairperson should be designated in advance of the proposal, based on his or her willingness to be responsible for the committee’s activities. The student and mentor should view the committee system as a source of objective criticism and expert advice. At the time of the thesis defense, the thesis committee serves as the Defense Committee and the mentor serves as the chair of the Defense Committee. The composition of the committee may change if there are changes in the scientific direction of the student. The addition of committee members or changes of committee composition should be made no later than six months before the defense date.

**Thesis Proposal and Thesis Committee Meetings**

The research proposed for the student's thesis work should be presented in a written “Thesis Proposal” prepared according to the format of an NIH research grant (12 pages, single-spaced, Arial font, 11 point). The thesis proposal should include a statement of purpose and rationale for the project, an outline of the methods to be used and an assessment of their feasibility, a summary of the work performed already, an idea of the potential outcome, and alternative plans for high risk portions of the project. Although these are all essential components of a proposal, it is not intended that the proposal be lengthy, and preliminary data, while desirable, need not be profuse or conclusive. In preparing a thesis proposal, students should seek assistance from their thesis mentor. The written proposal should be given to the members of the Thesis Committee at least 2 weeks prior to each Committee meeting. At the first meeting, the student should present the Proposal, along with relevant background and preliminary findings. The Thesis Committee will read and hear the Proposal and approve or reject it. At subsequent meetings the student should present progress and discuss future research plans/research direction.

The Thesis Committee will reach a consensus about the student’s progress, make recommendations regarding future experiments/project direction and summarize that consensus verbally to the student at the end of each meeting. The Committee Chair will send a written report to the Graduate Student Coordinator on the appropriate form. The Committee also should decide on the date for the next meeting, and include this information in the written summary.

Finally, the Thesis Committee will advise the student about an appropriate time to write the thesis. It is important to emphasize that the Thesis Proposal is considered a description of proposed/planned work, and it is not to be considered a binding document, as the direction of research may change as the project evolves.

For Ph.D. candidates, the Thesis Proposal should be presented ideally at the end of the second year but no later than the end of the 5th semester of graduate study. For M.D./Ph.D. students, the thesis proposal should be presented by December 31 of the second year of graduate study. Students not meeting this requirement would not be in good academic standing and could be dismissed if the proposal is not completed within the next 6 months.
Conflict of Interest Policy (COI)

Research funding from sources that have intellectual property interests in the research, or in which the PI has personal financial interest, may create a real or perceived conflict of interest, given the dual roles of the principal investigator in obtaining funding for the lab and as a mentor for graduate students. Issues of paramount importance are (i) the ability to publish results in a timely fashion; (ii) the ability to communicate research results openly, especially to members of the thesis committee; and (iii) academic rights to publish and speak freely, especially as related to a graduate student’s thesis and defense.

Statement of policy:

The following principles should apply to any situation involving a graduate student supported by funding that is associated with a confidentiality agreement:

- The limitations and nature of the confidentiality agreement must be fully disclosed to and approved by the student, the thesis committee, and the DBBS Associate Dean for Graduate Affairs;
- The confidentiality agreement must not place an unreasonable burden or delay in publication or reporting at scientific meetings;
- The confidentiality agreement must not delay the writing or defense of the thesis.
- The complete policy can be view at: http://dbbs.wustl.edu/curstudents/DBBSSStudentPolicies/Pages/ConflictofInterestPolicy.aspx

Detailed Thesis Outline

The student will prepare a written outline of major components and accomplishments of the thesis work at least 4 months prior to the expected date for the thesis defense. This outline will be discussed with the student at the final meeting of the Thesis Committee. The Committee may recommend additional work, or recommend that the student begin to prepare the Thesis. The research advisor (mentor) becomes the Chair at the defense. There should be 6 Thesis Committee members (per the thesis committee composition guidelines above) at the time of defense.

Thesis Defense

To be awarded a doctoral degree, a student must prepare and satisfactorily defend a doctoral thesis. The format of the thesis is prescribed by the Graduate School. Copies of the final written thesis should be in the hands of all members (including outside members) of the Thesis Committee at least 14 days prior to the scheduled defense. If they are not, the thesis defense will automatically be rescheduled at the Committee's earliest convenience.

Generally, the Thesis Defense consists of an oral presentation by the student of his/her principal findings, open questions from the audience, closed session questioning by the Thesis Committee, and final deliberation by the Committee. The Committee will determine whether the written thesis, the oral defense, and the responses to questions both from the general audience and members of the
Committee demonstrate that the completed work meets scientific criteria acceptable to the Committee.

At the end of each defense, the Thesis Examining Committee has three options:

a) to accept the thesis as written and presented,

b) to reject the thesis, and

c) to recommend acceptance of the thesis only after appropriate additions, deletions or corrections are made. While options (a) and (b) are fairly clear-cut, there is likely to be a range of possibilities for (c), from revising portions of the text and/or figures to requiring successful completion of additional work/experiments.

**Additional Forms Required**

Visit the DBBS website:
http://dbbs.wustl.edu/curstudents/StudentForms/Pages/GettingReadytoGraduate.aspx

**Students' Responsibility to Meet Program Requirements**

Graduate students in the HSG Program are responsible for completing the requirements of the program in a timely fashion. In particular, the requirements for courses, attending seminars and journal clubs, preliminary examinations, thesis proposals, and Thesis Advisory Committee meetings are important components of graduate training and should be regarded seriously. In the event that a student has trouble meeting any requirement, he or she should request consideration of the situation by the Program Directors, who may agree to waive or delay the requirement.

7. **Publications**

There is no specific requirement for publication to receive the Ph.D. However, high quality, peer-reviewed publications are an important determinant for a student’s career. Similarly, the process of writing and submitting a manuscript and responding to reviewer critiques is an essential part of a student’s training. Therefore, the publication record is one of several important and appropriate measures to be used by a thesis committee in evaluating a Ph.D. candidate. It is generally expected that students will have submitted and/or published one or more first author manuscripts in peer-reviewed journals at the time of the defense.

8. **Transfer From and To Other Programs**

Students are free to transfer to the HSG Program from any other program in the Division of Biology and Biomedical Sciences provided they are “in good academic standing”. Students who transfer will be expected to meet all of the normal requirements of the programs, although special exceptions may be granted in rare cases by the Steering Committee. Students in the HSG Program also are free to transfer from this program to another program, with the approval of both program directors and provided a qualifying examination committee or program steering committee has not recommended against the student continuing in the Ph.D. program. Transfer is accomplished most easily during the first year, but can be done at later times if necessary.
9. **Program Steering Committee**

Dr. John Atkinson  
Departments of Internal Medicine, Rheumatology, and Molecular Microbiology

Dr. Patrick Jay  
Departments of Pediatrics, Cardiology and Genetics

Dr. Michael A. Province  
Division of Statistical Genomics and Division of Biostatistics

Dr. John P. Rice  
Departments of Psychiatry, Genetics, and Mathematics, and Division of Biostatistics
<table>
<thead>
<tr>
<th>Year/ Sem</th>
<th>Coursework</th>
<th>Major Activities</th>
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<tbody>
<tr>
<td>Summer</td>
<td></td>
<td>Arrive in June to start first rotation (Optional)</td>
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</tbody>
</table>
| 1st year Fall | **Fundamentals of Mammalian Genetics**  
|             | **Human Linkage and Association**  
|             | **HSG Journal Club**  
|             | **Bio 590: Research-Rotation (first)** | **PhD Orientation (August)**  
|             | **Meet with Program Directors; plan rotations and coursework.**  
|             | **First Lab rotation** | |
| 1st year Spring | **Computational Statistical Genetics**  
|             | **Take an Elective**  
|             | **HSG Journal Club**  
|             | **Bio 590: Research-Rotation (second)** | **Take an appropriate Elective**  
|             | **Second Lab rotation** | |
| 1st year Summer | **Bio 590: Research-Rotation (third rotation latest during Fall of 2nd year)** | **Third Lab rotation (latest in 2nd year Fall)**  
|             | **Take foundational courses if necessary**  
|             | **Choose thesis laboratory at the end of the summer if doing the third lab rotation during the summer.** | |
| 2nd year Fall | **Take 2 electives**  
|             | **HSG Journal Club**  
|             | **Teaching Assistantship (Fall or Spring)**  
|             | **Bio 590: Research-Rotation (third rotation, if not taken during summer)** | **Choose thesis laboratory latest by September 1 (unless otherwise approved).** |
| 2nd year Spring | **Outstanding Electives or additional foundational courses**  
|             | **HSG Journal Club**  
|             | **Ethics – required** | **Complete Qualifying/ Qualifying Exam (an oral presentation followed by oral exam)**  
|             | **Form a Thesis Committee (meets at least once per year, preferably every 6 months)**  
|             | **Complete Thesis Research Proposal before the end of Summer (but no later than December 31)** | |
| 3rd year Fall | - Complete any additional coursework as needed | - Thesis research |
| 3rd year Spring | - Complete any additional coursework as needed | - Thesis research |
| 4th year to completion of degree | - **Bio 884**: Doctoral Continuing Student Status | - Thesis research |
| | | - Meet with *Thesis Committee* semi-annually |
| | | - Complete and defend thesis |
## Outline of Typical MSTP Student's Program

<table>
<thead>
<tr>
<th>Year/ Sem</th>
<th>Coursework</th>
<th>Major Activities</th>
</tr>
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</table>
| **Summer** | | • Research Rotation—students should rotate in both a “wet lab” molecular biology and human genetics and a “dry lab” analytical and computational techniques of genetic epidemiology and statistical genetics.  
• Take foundational courses if necessary. |
| **1st year Fall** | • Fundamentals of Mammalian Genetics  
• Human Linkage and Association  
• HSG Journal Club  
• **Bio 590**: Research  
Bio 5915: TA (Fall or Spring) | • PhD Orientation (August)  
• Meet with Program Directors to plan coursework.  
• Choose thesis advisor and begin thesis research.  
• Teaching Assistantship (Fall or Spring, depending on assignment). |
| **1st year Spring** | • HSG Journal Club  
• **Bio 590**: Research | • MSTP students that completed Fundamentals of Molecular Cell Biology during the first year of Medical School will have one advanced elective waived.  
• Complete Qualifying Exam by June 30. |
| **1st year Summer** | | • Take optional SAS course if necessary. |
| **2nd year Fall** | • HSG Journal Club  
• **Bio 884**: Continuing Graduate Student | • Choose a thesis committee and meet to propose thesis by December 31. |
| **2nd year Spring** | • HSG Journal Club  
• Ethics – required  
• **Bio 884**: Continuing Graduate Student | Thesis research  
Meet with Thesis Committee at least once per year, preferably semi-annually |
| **3rd year Fall** | • **Bio 884**: Continuing Graduate Student | • Thesis research |
| **3rd year Spring** | • **Bio 884**: Continuing Graduate Student | • Thesis research |
| **4th year** | • **Bio 884**: Continuing Graduate Student | • Complete and defend thesis. |
MSTP students joining the Human and Statistical Genetics Program may be required to take additional courses to compensate for any areas of deficiency. The educational background of each student will be reviewed by the Program Directors and it will be determined if additional courses are needed.

MSTP students are given credit for advanced elective courses from the Medical School curriculum, therefore the advanced elective requirement is waived for MSTP students unless otherwise determined by the Program Directors.

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