

THE GENETICS MAJOR

**STUDENT
HANDBOOK**

DEPARTMENT OF GENETICS



2016 - 2017 Academic Year

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I. Introduction

The Department of Genetics offers students majoring in Genetics the opportunity to work on important research problems with renowned scientists in state-of-the-art laboratories. While these opportunities are only possible in a major research university, Genetics majors still enjoy small class sizes and the personal attention one would expect only at a smaller college.

The Major in Genetics provides an excellent background in the natural sciences within an overall liberal arts curriculum. We provide comprehensive instruction in Mendelian, molecular, evolutionary, statistical, and computational genetics. Students not only learn the terms, concepts, and theories underlying the field of genetics, but also are able to use what they have learned to critically analyze published research as well as conduct their own research. At the end of four years, all of our students are able to design experiments, conduct the research using the appropriate laboratory techniques, and analyze and interpret their data. They also learn to communicate their discoveries through a written article appropriate for publication in a peer-reviewed journal, as well as through oral presentations and posters appropriate for scientific meetings. Upon completion of our degree, our students are prepared to enter graduate or professional schools, or the life sciences and health professions workforce.

Undergraduate research is the intellectual heart of our major. The Department is committed to teaching science through the way we *do* science - through the process of research and discovery. Every student completes *a minimum* of two semesters of laboratory research or independent study under the direction of a faculty member. Many of our students are authors on researcher papers in leading scientific journals. All of our undergraduate majors are afforded the opportunities formerly available only to Honors students.

Undergraduate students work closely with Genetics faculty members in addition to their research mentor. Upper-level elective courses have small enrollments. In addition, every student is assigned a faculty advisor upon declaring the major. This advisor can discuss course selection and career goals.

The success of our major is documented by the success of our students. Genetics is one of the smaller departments at Rutgers University but we consistently rank among the top three departments for students completing an Honors thesis. Our majors go on to top graduate and professional schools, or obtain technical positions conducting research in industry or academia.

This student handbook is meant to be an introduction to students who are considering majoring in Genetics. In addition, it is a quick reference that describes the curriculum and the requirements for conducting and completing the Genetics major. While the department updates this handbook regularly, students should nevertheless check the Genetics Department website or consult with a Genetics Department advisor to obtain information and guidance on the latest policies and procedures.

II. Departmental Contact Information

There are two departmental offices, both of which are located on the Busch campus in two different buildings. The Main Departmental Office, as well as the Human Genetics Institute, is in the Life Sciences Building, 145 Bevier Road, Piscataway, NJ 08854-8082 (henceforth called “LSB”). The Undergraduate Departmental Office is located in the Nelson Biological Laboratories Building, Room B416, 604 Allison Road, Piscataway, NJ 08854-8082 (henceforth called “Nelson”).

For most undergraduate administrative questions, students are encouraged to contact the administrative assistant in the Undergraduate Departmental Office:

Kathleen McDonald

Administrative Assistant for Undergraduate Education
Genetics Undergraduate Departmental Office
Nelson B-416, Busch Campus
Phone: 848-445-1146
geneticsoffice@biology.rutgers.edu

Students may also contact the Vice Chair for more specific questions concerning the requirements of the major:

Dr. Chris Rongo

Vice Chair
Waksman Institute, Room 33
Busch Campus
rongo@waksman.rutgers.edu

For Genetics Department administrative issues:

Marylou Carmona

Department Administrator
LSB 225, Busch Campus
Phone: 848-445-1638
carmona@biology.rutgers.edu

Dr. Linda Brzustowicz

Chair
LSB 231
Busch Campus
brzustowicz@biology.rutgers.edu

III. Faculty

Chair

Linda M. Brzustowicz, A.B., Harvard (Radcliffe); M.D., Columbia University

Distinguished Professors

Linda M. Brzustowicz, A.B., Harvard (Radcliffe); M.D., Columbia University

Jay A. Tischfield, B.S., Brooklyn College; M.Ph., Ph.D., Yale

Lei Yu, B.S., Wuxi College of Light Industry, Wuxi, China; M.S., Institute of Genetics, National Academy of Sciences, Beijing, China; Ph.D., California Institute of Technology, Pasadena, California

Professors

David E. Axelrod, B.S., Chicago; Ph.D., Tennessee

Maureen Barr, B.A., Rutgers University; Ph.D., Columbia University

Tara Matise, B.S., Cornell; M.S., Ph.D., Pittsburgh

Terry R. McGuire, B.S., Ohio State; Ph.D., Illinois (Emeritus)

Kim S. McKim, B.S., Simon Fraser University; Ph.D., University of British Columbia

Howard C. Passmore, A.B., Franklin and Marshall College; Ph.D., Michigan (Emeritus)

Christopher G. Rongo, B.A., UC San Diego; Ph.D., Mass. Institute of Technology

Amrik S. Sahota, B.S., Bath (UK); M.S., Loughborough (UK); Ph.D., London (UK)

Andrew W. Singson, B.S., UC Davis; Ph.D., UC San Diego

William H. Sofer, B.S., Brooklyn College; Ph.D., Miami (Emeritus)

Associate Professors

Andrew Brooks, B.S., Cornell University, Ithaca, N.Y.; M.S., University of Rochester School of Medicine; Ph.D., University of Rochester School of Medicine

Kevin Chen, A.B., Princeton University; M.S., Ph.D., UC Berkeley

Judy Flax, B.S., The College of NJ; M.A., Montclair State University; Ph.D., CUNY

Derek Gordon, B.A., University of Rochester; Ph.D., SUNY Stony Brook

Gary Heiman, B.A., Boston University; M.Sc., Sarah Lawrence; Ph.D., Columbia University

Bryce Nickels, B.S., Chemistry, Miami University; M.S., Ph.D., Harvard University

Lee D. Simon, B.A., Wesleyan; M.S., Ph.D., Rochester (Emeritus)

Navin K. Sinha, B.S., M.S., Patna (India); Ph.D., Minnesota (Emeritus)

Changshun Shao, B.S., Normal University (China); M.M., Shandong Medical University (China); Ph.D., Indiana University School of Medicine

Gleb Shumyatsky, B.A., Moscow State University; Ph.D., Institute of Molecular Genetics (Moscow)

Ann C. St. John, B.S., Penn State; M.S. Ph.D., Wisconsin-Madison. (Emeritus).

Assistant Professors

Marco Azaro, B.A., Brown University; Ph.D., Brown University

Christopher Ellison, B.A., Lewis & Clark College; Ph.D., UC Berkeley

Andrew Kern, Sc.B., Brown University; Ph.D., UC Davis
Jennifer Moore, B.S., UNC Charlotte; Ph.D., UNC Chapel Hill
Karen Schindler, B.S., Loyola University; Ph.D., Thomas Jefferson University
Lourdes Serrano, B.Sc., Ph.D., Universidad Autonoma de Madrid (Spain)
Premal Shah, B.T., Anna University (India) ; Ph.D., University of Pennsylvania
Michael Sheldon, B.A., Cornell; Ph.D., SUNY at Stony Brook
Michael Verzi, B.A., The College of New Jersey; Ph.D. UCSF
Jinchuan Xing, Ph.D., Louisiana State University

Lecturers

Doreen Glodowski, B.S., University of Wisconsin-Stevenspoint; M.S., Kansas State University; Ph.D., University of Wisconsin-Madison
Martha B. Haviland, B.A., Rutgers; M.S., A.M., Ph.D., Michigan
Ron C. Michaelis, Ph.D., Vanderbilt University
Natalia Morsci, B.Sc., Ph.D., University of Wisconsin Madison

Adjunct Faculty

Steven G. Buyske, B.A., Haverford College; M.Sc., Brown University; Ph.D. Brown University; Ph.D., Rutgers University
Suzie Chen, B.S., Trinity College; M.S., Ph.D., Albert Einstein College of Medicine
Bonnie Firestein-Miller, B.S., Michigan; Ph.D. UC San Diego
Michele B. Horner, B.A., Rutgers University; M.S., University of Pittsburgh
Gopala Kovvali, B.S. Andhra University (India); M.S., University of Hyderabad (India); Ph.D., University of Delhi (India)
James Millonig, B.S., University of Rochester; M.Sc., University of Oxford; Ph.D., Princeton University
Joaquin Santolaya, M.D., Universidad Autónoma de Madrid; Ph.D., University of London (UK)
Leonard Sciorra, B.A., Rutgers University; M.S., Seton Hall University; Ph.D., Hahnemann Medical School (now Drexel University College of Medicine)
Zhiyuan Shen, M.D., Norman Bethune University of Medical Sciences; M.S., Institute of Radiation Medicine (China); Ph.D., CSU
Deanne Taylor, B.A., Wellesley College; Ph.D., University of Michigan
Nathan Treff, B.S., Eastern Washington University; Ph.D., Washington State University
Jon F. Wilkins, A.B., Harvard College; M.S., University of Wisconsin; Ph.D., Harvard University
Barbie Zimmerman-Bier, B.A./M.D., Brooklyn College; M.D., SUNY Downstate Medical School

IV. Declaring the Major

Students wishing to major in Genetics must have satisfied the following requirements:

- Be a School of Arts and Sciences (SAS) student
- Been enrolled at Rutgers University for at least one semester.
- Have a cumulative GPA of at least 2.00 (*Note that a GPA of 2.80 is required to register for independent research and therefore to graduate in the major*)
- Have earned a “C” or better in the following courses or their equivalents (e.g., AP credit, officially accepted transfer credit, et cetera):
 - General Biology (119:115-116)
 - General Biology Lab (119:117)
 - General Chemistry, either of these two-course combinations:
 - 160:161-162
 - 160:163-164
 - Mathematics, any one of these two-course combinations:
 - 640:135,138 (Calculus I, Calculus II for the Biological Sciences)
 - 640:151-152 (Calculus I and II for Mathematical and Physical Sciences)
 - 640:135 and 960:401 (Basic Statistics for Research)
 - 640:151 and 960:401 (Basic Statistics for Research)

Note: A grade of "C" or better in courses credited toward the major is required for graduation, and each course may be repeated only once to replace D/F grades. 640:136 (Calc II, 4 cr) may be substituted for 640:138. 640:192 (Honors Calc II, 4 cr) may be substituted for 640:152. 960:379 (Basic Probability) may be substituted for 960:401 (Basic Stats for Research).

To declare the major, students should register online at MyMajor.sas.rutgers.edu

Please note that SEBS no longer allows their students to major in Genetics. Only students who entered Rutgers/SEBS in 2014 (i.e., the Class of 2018) or earlier will be allowed to declare the Genetics major. SEBS students interested in declaring the Genetic major can request a transfer to SAS:

<http://sasundergrad.rutgers.edu/admissions/admissions/school-to-school-transfer>

Once students have completed their online registration, they must be approved by the Department Chair or Vice Chair. No one will be approved for the major until they have filled out the Genetic Major Information Form, which can be found on the Student Forms page of the Department website:

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/student-forms>

Students who have applied through MyMajor will be added to the “Pending Majors” SAKAI site, where they can track their progress through the prerequisites. The completed Genetics Major Information Form should be uploaded to this SAKAI website. All communication with students will be conducted electronically, so make sure the Department knows your current email address. If you change your email or want to use an alternative email address (e.g., aol, yahoo, gmail), please notify Ms. Kathleen McDonald at geneticsoffice@biology.rutgers.edu.

There is no minor in Genetics. Please note that students may not major in more than one of the four programs of study offered by the Division of Life Sciences. In addition, students may not declare a major in both Genetics and Biotechnology (SEBS), or Genetics and Microbiology (SEBS). In general, students may not major in Genetics and minor in a Biology-oriented program from SEBS. Contact the Vice Chair (rongo@waksman.rutgers.edu) if you have questions about a second major. Students majoring in Genetics may not minor in one of the other programs offered by the Division of Life Sciences.

V. Learning Goals and Curriculum

The curriculum of the Department of Genetics is centered around four main goals:

1. Knowledge specific goals: Know the terms, concepts and theories in the field of genetics.
2. Integrate the material from multiple courses and research. That is, to think holistically and to see the whole as well as the parts.
3. Use genetic information and ideas to critically analyze published research articles in the field of genetics.
4. At the end of four years, all our students will be able to design an experiment, carry out the research using the appropriate laboratory techniques and analyze and interpret their data. They will also be able to communicate their discoveries through a written article appropriate for publication in a peer-reviewed genetics journal, and through talks or posters appropriate for scientific meetings.

The present curriculum is based on the Rutgers New Brunswick Undergraduate Catalog 2015-2017 (<http://www.rutgers.edu/academics/catalogs>). The curriculum applies to students in the Class of 2015 and thereafter. The Genetics Major Curriculum is comprised of three components:

1. The Required Division of Life Sciences (DLS) Core
2. The Genetics Major Core
3. The Genetics Research and Electives Requirement

1. The Division of Life Sciences Core

- General Biology (119:115-116)
- General Biology Lab (119:117)
- General Chemistry, either of these two-course combinations:
 - 160:161-162 (General Chemistry)
 - 160:163-164 (Honors General Chemistry)
 - 160:163-164 (General Chemistry – Special Sections)
- Introduction to Experimentation (160:171)
- Organic Chemistry, either of these two-course combinations:
 - 160:307-308 (Organic Chemistry)
 - 160:315-316 (Honors Organic Chemistry)
- Organic Chemistry Laboratory (160:311)
- Calculus I (any one of these):
 - 640:135 (Calculus I)
 - 640:151 (Calculus I for Mathematical and Physical Sciences)
 - 640:191 (Honors Calculus I)
- Calculus II or Statistics (any one of these):
 - 640:136 (Calculus II)

- 640:138 (Calculus II for the Biological Sciences)
- 640:152 (Calculus II for Mathematical and Physical Sciences)
- 640:192 (Honors Calculus II)
- 960:379 (Basic Probability and Statistics)
- 960:401 (Basic Statistics for Research)
- 960:211-212 (Statistics I & II combination)
- General Physics (any one of these):
 - 750:203-204 (General Physics combination) and 750:205-206 (lab combo)
 - 750:193-194 (Physics for the Sciences – includes lab)
 - 750:271-272 (Honors Physics combo) and 750:275-276 (lab combo)
 - 750:201-202 (Extended General Physics combination – includes lab)

Note: Appropriate AP credits or transfer courses approved by the Office of Undergraduate Instruction (OUGI) may be substituted. Other substitutions are described in the Curriculum Worksheet, available at

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/student-forms>

and require the permission of the departmental Vice Chair (rongo@waksman.rutgers.edu).

2. The Genetics Major Core

- Genetic Analysis I and II (447:384-385)
- Biochemistry, either of these two courses:
 - Introduction to Biochemistry (694:301)
 - Molecular Biology and Biochemistry (694:407)
- Genetics Laboratory Course, one of these four courses:
 - Introduction to Research in Genetics (447:315)
 - Quantitative Biology and Bioinformatics (447:302)
 - Introduction to Molecular Biology and Biochemistry (694:214)
 - Honors Introduction to Molecular Biology and Biochemistry (694:215)
 - Honors Introduction to Molecular Biology, Biochemistry, and Genetics Research (694:316)
- Communication in Genetics, either of these two:
 - Effective Communication Skills in Genetics (447:430)
 - Thesis Writing and Communication in Genetics (447:414-415)

Note:

- *Genetics 447:380 may not be substituted for either Genetics Analysis I or II (447:384-385)*
- *If a student should switch from the Genetics major to one of the other Division of Life Sciences majors, both 447:384 and 447:385 (and only both) may be used to fulfill the Genetics requirement for those majors (normally fulfilled by Genetics 447:380)*
- *Genetics major core requirements cannot be satisfied by transfer courses*

- *The 11:115:403-404 (General Biochem, 3,3 cr.) series may be substituted for 694:301 (Intro to Biochem) but is not recommended. Requires the permission of the departmental Vice Chair*
- *447:315, 447:302, and 694:214 are only offered in the Spring semester*
- *694:215 and 694:316 are only offered in the Fall semester and to SAS Honors students*
- *447:214 and 447:215 are only offered to first-year students with AP Biology credit and AP General Chemistry credits (or taking General Chemistry concurrently)*
- *447:430 must be taken after having completed one or more semesters of independent research (preferably taken concurrently with their second semester of research)*
- *Students doing an Honors thesis in Genetics will take the 447:414-415 series in their senior year (concurrent with Honors in Genetics 447:408-409) instead of 447:430*

3. The Genetics Research and Electives Requirement

Students must complete:

- 6 credits of Research or Independent Scholarship taken with a single advisor over two semesters (except for the Genetic Counseling Rotation, which is performed under more than one advisor)
 - Research in Genetics (447:406-407)
 - Honors in Genetics (447:408-409)
 - Research in Genetics – Writing Intensive (447:410)
 - Genetic Counseling Rotation (447:488)
 - Advanced Independent Study in Genetics (447:489-490)
- 6 credits of approved Genetics electives (see list below)
- 6 or more additional credits of either Research/Scholarship or approved Genetics electives

There are alternative routes through the Genetics major. One student might enter a research laboratory in his or her junior year and complete 12 credits of research (3 per semester) for two years. Another student might work with a faculty member during his or her Senior year to develop educational software for Genetics (6 credits of *Advanced Independent Study*). A third student might complete a year of research in his or her junior year and then complete a year of *Advanced Independent Study* developing informational websites. Some example pathways for completing the major are provided at the end of this handbook. Each student has a faculty advisor and can develop their individualized major within the overall guidelines.

Additional information about specific courses can be found on the Genetics Department website:

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/course-descriptions>

and at the DLS course description website:

<http://biology.rutgers.edu/courses>

To help students plan and follow their progress in the major, we have provided a Curriculum Worksheet on the Departmental website:

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/student-forms>

All students are responsible for making sure that they are on target for their appropriate graduation date. This can easily be done by:

- Keeping careful records using the Curriculum Worksheet
- Seeing your assigned advisor at least once per semester
- Making reference to the *Student Handbook for the Genetics Major*
- Checking Degree Navigator (nbdn.rutgers.edu)

In addition, the Department often sends general announcements during the year as reminders. All announcements to students will be sent electronically, so students should make sure the Department has their most current email address on file.

Students should follow the curriculum as outlined in the worksheets, **not** as listed in the catalog. The online catalog might not reflect the most recent curriculum.

Please note that a grade of “C” or better in courses credited toward the major is required for graduation (i.e., all the courses listed in the worksheet). Under no circumstances will grades of credit/no credit or pass/fail be accepted.

Accepted Electives for the Genetics Major.

Note: Many courses are offered during only one semester. Some are offered every other year.

01:447:216	<i>Analysis of Scientific Literature (3) – Spring – Honors</i>
01:447:302	<i>Quantitative Biology and Bioinformatics (3) – Spring</i>
01:447:352	<i>Genome Evolution (3) – Fall</i>
01:447:354	<i>Social, Legal and Ethical Issues of the New Genetics (3) – Fall</i>
01:447:370	<i>Developmental Genetics (3) – Spring</i>

01:447:451	<i>Genomes (3) - Fall</i>
01:447:460	<i>Genetics of Compulsive Behavior (3) - Spring</i>
01:447:465	<i>Mutant Isolation and Analysis (3) – Fall</i>
01:447:478	<i>Special Topics in Genetics (3) - Offered irregularly</i>
01:447:479	<i>Special Topics in Genetics (3) - Offered irregularly</i>
01:447:481	<i>Topics in Human Genetics (3) – Fall</i>
01:447:484	<i>Behavioral and Neural Genetics (3) – Spring</i>
01:447:486	<i>Evolutionary Genetics (3) – Fall</i>
01:447:495	<i>Cancer (3) – Fall</i>
01:694:411	<i>Molecular Pathways & Signal Transduction (3) – Fall</i>
01:694:413	<i>Chromatin and Epigenomics (3) – Fall</i>
01:694:492	<i>Mol Bio of Gene Reg & Development (3) – Spring</i>
11:126:427	<i>Methods Recomb. DNA Tech (4) - Fall</i>
11:680:480	<i>Microbial Genetics & Genomics (3) - Spring</i>
11:126:483	<i>Nucleotide Sequence Analysis (3) - Both</i>
11:126:485	<i>Bioinformatics (3) - Spring</i>
11:126:444	<i>Advanced Techniques in Biosciences (3) - Spring</i>

Using Degree Navigator For The Genetics Major

Genetics majors may also use Degree Navigator to determine whether they are on track for graduation:

<http://nbdn.rutgers.edu>

When students log into Degree Navigator, they should select “Major in Genetics (NB)” and version “Fall 2014” for the most updated version of the major. The program description for the major, along with its specific conditions, will appear as the following:

Requirements

Requirement V1 : General Biology - Types: Major

The required number of courses from 1 of the following sets of courses:

All of {[01:119:115](#), [01:119:116](#), [01:119:117](#)} (Total = 3 courses)

or

All of {[01:119:101](#), [01:119:102](#)} (Total = 2 courses)

Notes:

- Each course may be repeated only once to replace D/F grades.

* *Related Conditions: N17; N23*

Requirement V2 : General Chemistry - Types: Major

The required number of courses from 1 of the following sets of courses:

All of {[01:160:161](#), [01:160:162](#)} (Total = 2 courses)

or

All of {[01:160:163](#), [01:160:164](#)} (Total = 2 courses)

or

All of {[01:160:165](#), [01:160:166](#)} (Total = 2 courses)

Notes:

- Each course may be repeated only once to replace D/F grades.

* *Related Conditions: N17; N23*

Requirement V3 : Calculus I - Types: Major

1 course from 1 of the following sets of courses:

- {01:640:135}
- or {01:640:151}
- or {01:640:191}

Notes:

- Each course may be repeated only once to replace D/F grades.

* *Related Conditions: N17; N23*

Requirement V4 : Calculus II or Upper Level Statistics - Types: Major

1 course from 1 of the following sets of courses:

- {01:640:138}
- or {01:640:136}
- or {01:640:152}
- or {01:640:192}
- or {01:960:379}
- or {01:960:401}
- or {01:960:212}

Notes:

- Each course may be repeated only once to replace D/F grades.

* *Related Conditions: N17; N23*

Requirement V5 : Specialized Chemistry and Labs - Types: Major

The required number of courses from 1 of the following sets of courses:

All of {01:160:171, 01:160:307, 01:160:308, 01:160:311} (Total = 4 courses)

or

All of {01:160:171, 01:160:315, 01:160:316, 01:160:311} (Total = 4 courses)

Notes:

- Each course may be repeated only once to replace D/F grades.

* Related Conditions: N17; N23

Requirement V6 : Physics I - Types: Major

The required number of courses from 1 of the following sets of courses:

All of {01:750:203, 01:750:205} (Total = 2 courses)

or

All of {01:750:193} (Total = 1 course)

or

All of {01:750:271, 01:750:275} (Total = 2 courses)

or

All of {01:750:201} (Total = 1 course)

Notes:

- Each course may be repeated only once to replace D/F grades.

* Related Conditions: N17; N23

Requirement V7 : Physics II

The required number of courses from 1 of the following sets of courses:

All of {01:750:204, 01:750:206} (Total = 2 courses)

or

All of {01:750:194} (Total = 1 course)

or

All of {01:750:272, 01:750:276} (Total = 2 courses)

or

All of {01:750:202} (Total = 1 course)

Notes:

- Each course may be repeated only once to replace D/F grades.

* Related Conditions: N17; N23

Requirement V8 : Genetics Lecture - Types: Major

A total of 2 courses from {01:447:384, 01:447:385}

Notes:

- Each course may be repeated only once to replace D/F grades.

* *Related Conditions: N17; N13; N23*

Requirement V9 : Genetics Lab - Types: Major

1 course from 1 of the following sets of courses:

- {01:447:315}
- or {01:447:302}
- or {01:694:214}
- or {01:694:215}
- or {01:694:316}

Notes:

- Each course may be repeated only once to replace D/F grades.

* *Related Conditions: N17; N13; N23*

Requirement V10 : Biochemistry - Types: Major

The required number of courses from 1 of the following sets of courses:

All of {01:694:301} (Total = 1 course)

or

All of {11:115:403, 11:115:404} (Total = 2 courses)

or

All of {01:694:407} (Total = 1 course)

Notes:

- Each course may be repeated only once to replace D/F grades.

* *Related Conditions: N17; N13; N23*

Requirement V11 : Communication in Genetics - Types: Major

The required number of courses from 1 of the following sets of courses:

All of {01:447:430} (Total = 1 course)

or

All of {01:447:414, 01:447:415} (Total = 2 courses)

Notes:

- Each course may be repeated only once to replace D/F grades.

* *Related Conditions: N17; N13; N23*

Requirement V12 : Independent Scholarship and Genetics Electives - Types: Major

The required number of credits from 1 of the following sets of courses:

The required number of credits from 3 of the following sets of courses:

12 credits from {Independent Scholarship in Genetics}
and 3 credits from {Genetics Electives from the Genetics Department}
and 3 credits from {Genetics Electives}

or

The required number of credits from 3 of the following sets of courses:

9 credits from {Independent Scholarship in Genetics}
and 6 credits from {Genetics Electives from the Genetics Department}
and 3 credits from {Genetics Electives}

or

6 credits from 3 of the following sets of courses:

{Independent Scholarship in Genetics}
and {Genetics Electives from the Genetics Department}
and {Genetics Electives}

Notes:

- Approved graduate courses may be used for elective credit.
- Students may not receive credit for both 01:447:245 and 01:447:495.
- A minimum of 6 credits of independent scholarship is required. This must be taken over two semesters with a single advisor.
- 01:447:406-407 Research in Genetics requires a GPA of 2.8 or better or permission of Vice Chair.
- Each course may be repeated only once to replace D/F grades.
- 01:447:408-409 Honors Research in Genetics requires a GPA of 3.4 or better and requires concurrent registration in 01:447:414 (Fall) and 01:447:415 (Spring).

* *Related Conditions: N17; N19; N20; N21; N22; N13; N23; N24*

Conditions

Condition N13 : Residency Requirement in RU-NB - Types: Major

No credits may be used from {Non-New Brunswick Courses} in requirements {V8 - Genetics Lecture, V9 - Genetics Lab, V10 - Biochemistry, V11 - Communication in Genetics, V12 - Independent Scholarship and Genetics Electives}.

Condition N17 : Minimum Grade - Types: Major

You must achieve a minimum grade of C for {all courses} in requirements {V1 - General Biology, V2 - General Chemistry, V3 - Calculus I, V4 - Calculus II or Upper Level Statistics, V5 - Specialized Chemistry and Labs, V6 - Physics I, V7 - Physics II, V8 - Genetics Lecture, V9 - Genetics Lab, V10 - Biochemistry, V11 - Communication in Genetics, V12 - Independent Scholarship and Genetics Electives}.

Condition N19 : Electives - Types: Major

(Applies to requirement {V12 - Independent Scholarship and Genetics Electives})
Approved graduate courses may be used for elective credit.

Condition N20 : Electives - Types: Major

(Applies to requirement {V12 - Independent Scholarship and Genetics Electives})
Students may not receive credit for both 01:447:245 and 01:447:495.

Condition N21 : Independent Scholarship - Types: Major

(Applies to requirement {V12 - Independent Scholarship and Genetics Electives})
A minimum of 6 credits of independent scholarship is required. This must be taken over two semesters with a single advisor.

Condition N22 : Research - Types: Major

(Applies to requirement {V12 - Independent Scholarship and Genetics Electives})
01:447:406-407 Research in Genetics requires a GPA of 2.8 or better or permission of Vice Chair.

Condition N23 : Repeating Courses - Types: Minor

(Applies to requirements {V1 - General Biology, V2 - General Chemistry, V3 - Calculus I, V4 - Calculus II or Upper Level Statistics, V5 - Specialized Chemistry and Labs, V6 - Physics I, V7 - Physics II, V8 - Genetics Lecture, V9 - Genetics Lab, V10 - Biochemistry, V11 - Communication in

Genetics, V12 - Independent Scholarship and Genetics Electives, N17 - Minimum Grade, N13 - Residency Requirement in RU-NB}}

Each course may be repeated only once to replace D/F grades.

Condition N24 : Research - Types: Major

(Applies to requirement {V12 - Independent Scholarship and Genetics Electives})

01:447:408-409 Honors Research in Genetics requires a GPA of 3.4 or better and requires concurrent registration in 01:447:414 (Fall) and 01:447:415 (Spring).

Courses

Independent Scholarship in Genetics

Code	Credits	Name
01:447:406	3,4,5,6	Research in Genetics (NB)
01:447:407	3,4,5,6	Research in Genetics (NB)
01:447:408	3,4,5,6	Honors in Genetics (NB)
01:447:409	3,4,5,6	Honors in Genetics (NB)
01:447:410	3	Research in Genetics - Writing Intensive (NB)
01:447:488	3	Genetic Counseling Rotation (NB)
01:447:489	3	Advanced Independent Study in Genetics (NB)
01:447:490	3	Advanced Independent Study in Genetics (NB)
11:015:497	3,4,5,6	George H. Cook Scholars Program (NB)
11:015:497	3,4,5,6	George H. Cook Scholars Program (NB)

Genetics Electives from the Genetics Department

Code	Credits	Name
01:447:216	3	Analysis of Scientific Literature (Honors) (NB)
01:447:302	3	Quantitative Biology and Bioinformatics (NB)
01:447:352	3	Genome Evolution (NB)
01:447:354	3	Social, Legal and Ethical Implications of the New Genetics (NB)
01:447:356	3	Evolutionary Medicine (NB)
01:447:370	3	Developmental Genetics (NB)
01:447:451	3	Genomes (NB)
01:447:460	3	Genetics of Compulsive Behavior (NB)
01:447:465	3	Mutant Isolation and Analysis (NB)
01:447:478	3	Special Topics in Genetics (NB)
01:447:479	3	Special Topics in Genetics (NB)
01:447:481	3	Topics in Human Genetics (NB)

01:447:484	3	Behavioral and Neural Genetics (NB)
01:447:486	3	Evolutionary Genetics (NB)
01:447:495	3	Cancer (NB)

Genetics Electives

Code	Credits	Name
01:447:216	3	Analysis of Scientific Literature (Honors) (NB)
01:447:302	3	Quantitative Biology and Bioinformatics (NB)
01:447:352	3	Genome Evolution (NB)
01:447:354	3	Social, Legal and Ethical Implications of the New Genetics (NB)
01:447:356	3	Evolutionary Medicine (NB)
01:447:370	3	Developmental Genetics (NB)
01:447:451	3	Genomes (NB)
01:447:460	3	Genetics of Compulsive Behavior (NB)
01:447:465	3	Mutant Isolation and Analysis (NB)
01:447:478	3	Special Topics in Genetics (NB)
01:447:479	3	Special Topics in Genetics (NB)
01:447:481	3	Topics in Human Genetics (NB)
01:447:484	3	Behavioral and Neural Genetics (NB)
01:447:486	3	Evolutionary Genetics (NB)
01:447:495	3	Cancer (NB)
01:694:411	3	Molecular Pathways and Signal Transduction (NB)
01:694:413	3	Chromatin and Epigenomics (NB)
01:694:492	3	Gene Regulation in Cancer and Development (NB)
11:126:427	4	Methods and Approaches in Molecular Biology (NB)
11:126:444	3	Advanced Techniques in Biosciences (NB)
11:126:483	3	Nucleotide Sequence Analysis (NB)
11:126:485	3	Bioinformatics (NB)
11:680:480	3	Microbial Genetics & Genomics (NB)

VI. Genetic Counseling Certificate Program (GCCP)

The Department of Genetics offers an undergraduate Certificate in Genetic Counseling (CGC) for students interested in later applying to Masters-level programs in Genetic Counseling after graduation. The goal of the GCCP is to provide students with guidance, coursework, and relevant clinical experience for graduate school applications. This is a highly competitive option and is only open to declared Genetics majors. The Certificate will be awarded only in conjunction with the awarding of a baccalaureate degree in Genetics.

At the end of the program students will:

- Understand Genetic Counseling as a profession
- Understand application requirements for Masters-level programs
- Gain experience in talking with people who are in crisis
- Gain experience in a clinical Genetic Counseling clinic

Students accepted into the GCCP will meet weekly with the GCCP director for one semester and attend a rotation at a local Genetic Counseling clinic. At the clinic, students will observe counseling sessions, perform literature searches, observe weekly clinical and ultrasound meetings, and assist with chart preparation (for more information, see below). In addition, all successful applicants are expected to volunteer at a crisis hotline such as *We Care* or *Scarlet Listeners*. All questions about the program should be directed to [Dr. Gary Heiman \(heiman@biology.rutgers.edu\)](mailto:heiman@biology.rutgers.edu). For a more information on the genetic counseling career see <http://nsgc.org/p/cm/ld/fid=44>

Prerequisites for Certificate Program:

- Declared the Genetics major
- Have a minimum 2.80 GPA
- Interview with the GCCP Director (Dr. Gary Heiman)
- Completion of the Rutgers University Human Subjects Certification (IRB)

Required Courses (15 credits) and Volunteer Experience

- Genetic Counseling Rotation (447:488) – *special permission required.*
- Basic Statistics Coursework (960:401 or 960:379)
- General Psychology (830:101)
- Abnormal Psychology (830:340)
- A Bioethics Course (3 credits), either:
 - Social, Legal and Ethical issues and the new Genetics (447:354)
 - Bioethics (730:249)
 - Genetics, Law, and Social Policy (119:154)
- Crisis Hotline experience: Students must volunteer at a hotline for at least one semester, such as *CONTACT We Care* or *Scarlet Listeners*.

Genetic Counseling Rotation (447:488)

Students will be placed at a local Genetic Counseling clinic to shadow a genetic counselor for one semester. This course can only be taken once. During this semester, the student is expected to spend 8 hours a week at the rotation plus meet weekly with the GCCP Director, Dr. Heiman.

Grade for rotation credit will be based on:

- Case presentation to the Genetic Counseling group, and
- 10 Genetic Counseling case summary logs reviewed by Dr. Heiman.

Each rotation placement has its own prerequisites and can include:

- Passing a 5-panel drug screen (paid by student)
- Passing a criminal background check (paid by student), which is required by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO)
- Completing the hospital orientation manual (self study) and passing the quiz.

Note: The Genetic Counseling Rotation course (01:447:488) counts as 3 research credits for the Genetics major. The other three required research credits may be fulfilled with a related Advanced Independent Study Project, or with a 3-credit research project with a faculty member or in the Rutgers University Cell and DNA Repository (RUCDR).

VII. Computational Genetics Certificate Program

The Department of Genetics offers a Certificate in Computational Genetics (CCG). The volume of data being generated in Genetics and related life science fields has been expanding tremendously in recent years, and career opportunities for geneticists with computational and quantitative expertise are simultaneously growing. This proposed certificate program is intended for students who are either interested in applying to graduate-level programs or planning careers in Computational Genetics, Statistical Genetics, Bioinformatics, or other programs in quantitative biomedical related research. The goal of the CCG is to provide students with guidance, coursework, and relevant data design and analysis experience necessary for graduate school applications. This is a highly competitive option and only open to declared Genetics Majors. The Certificate is awarded only in conjunction with the awarding of a baccalaureate degree in Genetics.

At the end of the program students will:

- Have gained competence in genetic data analysis using basic computer programming and statistical analysis
- Be prepared to apply to M.S. or Ph.D. graduate programs in the areas of Computational Genetics and Bioinformatics
- Be prepared to apply for career positions in industry, biotech companies, pharmaceutical companies, medical centers, or universities

Students accepted into the certificate program will meet regularly with the CCG director and participate in a Computational Genetics lab for at least two semesters. Completion of the certificate will require an additional 10 credits beyond those needed to complete the Genetics major. Either 3 or 7 of those additional credits could be applied to a minor in either statistics or computer science, respectively. All questions about the program should be directed to Dr. Derek Gordon (gordon@biology.rutgers.edu).

Prerequisites for Certificate Program:

- Declared the Genetics major
- Have a minimum 2.80 GPA
- Interview with the Program Director (Dr. Derek Gordon)

Required Courses (22 credits)

- Introduction to Computer Science (198:111)
- Data Structures (198:112)
- Basic Probability (960:379)
- Introduction to Statistical Analysis (960:384)
- Quantitative Biology & Bioinformatics (447:302)
- Research in Genetics (6 credits total)
 - Standard Version (447:406-407)
 - Honors Version (447:408-409)

Students interested in Computational Genetics might also consider completing a minor (or a double major) in:

- Computer Science (<http://www.cs.rutgers.edu>)
- Statistics (<http://www.stat.rutgers.edu>)
- Biomathematics (<http://www.biomath.rutgers.edu>)

Note:

- *The courses 447:302, 447:406-407, 447:408-409, and 960:379 satisfy different requirements for the Genetics major.*
- *All Genetics majors are required to take at least two semesters (6-12 credits) of a research course (447:406,407,408,409,410,488).*
- *The 447:410 can be substituted for 447:406-407.*
- *Statistics 960:401 may be substituted for 960:384*
- *Statistics 960:381 may be substituted for 960:379*
- *The 960:384 course may be used to fulfill the elective requirements of a Statistics minor.*
- *The 198:111 and 198:112 courses may be used to fulfill the elective requirements of a Computer Science minor.*

VIII. Advising

Each student will be assigned a faculty advisor from the Department of Genetics. In most cases, this advisor will remain the student's advisor for the balance of the time that he or she is a major. The role of the advisor is to:

- Assist students in course selection
- Monitor student progress to ensure that all requirements are fulfilled by graduation
- Approve students for enrolling in independent research
- Assist, where possible, in career planning

Students are encouraged to see their advisor on a regular basis, generally once or twice per academic year. Please feel free to contact advisors by email to make appointments or to ask specific questions that do not require a full appointment. It is the student's responsibility to make sure that he or she is on target for graduation. Students completing the junior year should schedule an appointment with their advisor to review their program for their final year. If in doubt, students should make use of their advisor! Advisors are listed by graduating class:

Class	Last Name of Student	Advisor	Contact Info
2017 (Seniors)	A to F	Dr. Lei Yu	yu@biology.rutgers.edu CAS 215
	G to L	Dr. Derek Gordon	gordon@biology.rutgers.edu LSB 128
	M to Q	Dr. Bryce Nickels	nickels@waksman.rutgers.edu Waksman 335
	R to Z	Dr. David Axelrod	axelrod@biology.rutgers.edu Nelson B341
2018 (Juniors)	A to F	Dr. Andy Kern	kern@biology.rutgers.edu Nelson C217
	G to L	Dr. Kim McKim	mckim@rci.rutgers.edu Waksman 206
	M to Q	Dr. Kevin Chen	kcchen@biology.rutgers.edu Nelson C225
	R to Z	Dr. Gleb Shumyatsky	gleb@biology.rutgers.edu LSB 322
2019 (Sophomores)	A to K	Dr. Maureen Barr	barr@biology.rutgers.edu LSB 324
	L to R	Dr. Andy Singson	singson@waksman.rutgers.edu Waksman 123A
	S to Z	Dr. Tara Matise	matise@biology.rutgers.edu LSB 122
2020 (Freshman) & Transfer Students	All	Dr. Chris Rongo	rongo@waksman.rutgers.edu Waksman 33
Genetic Counseling	All	Dr. Gary Heiman	heiman@biology.rutgers.edu LSB 125

IX. Research – Getting Started

Students can do research with any appropriate faculty member at Rutgers-New Brunswick. It is ultimately the responsibility of the student to identify a research mentor to sponsor their independent studies. The hardest part about undergraduate research is finding a faculty mentor who has the space and resources to accept the student into his or her research lab. We recommend that students browse through research faculty websites to draw up a list of a dozen or more researchers conducting studies that are of interest to the student. It is the responsibility of the student to contact potential faculty mentors. Students should familiarize themselves with the research of potential faculty prior to contacting them about possible laboratory positions.

Web Sites Containing Information about Faculty Research Interests

- **Molecular Biosciences Graduate Program** (a good centralized resource)
 - <http://molbiosci.rutgers.edu/faculty.htm>
- **Genetics Department**
 - <https://genetics.rutgers.edu/faculty/faculty-list>
- **Genetics Department Faculty by Research Area**
 - <http://genetics.rutgers.edu/faculty/faculty-research>
- **The Waksman Institute**
 - <http://www.waksman.rutgers.edu/research/labs>
- **Department of Molecular Biology and Biochemistry**
 - <http://mbb.rutgers.edu/faculty>
- **Department of Cell Biology and Neuroscience**
 - <https://cbn.rutgers.edu/faculty/faculty>
- **SEBS Departments**
 - <http://sebs.rutgers.edu/departments/>
- **Center for Advanced Biotechnology and Medicine**
 - http://www3.cabm.rutgers.edu/faculty_and_research/index.php
- **Cancer Institute of New Jersey**
 - <http://cinj.org/research/research-overview>
- **Environmental and Occupational Health Sciences Institute**
 - <http://eohsi.rutgers.edu>
- **Ernesto Mario School of Pharmacy**
 - <http://pharmacy.rutgers.edu/>
- **Robert Wood Johnson Medical School**
 - http://rwjms.rutgers.edu/departments_institutes/index.html

An appropriate time for students to begin the search for a laboratory for research would be during the semester *just prior to* starting research. If you want to start research in the fall semester, a good time to start looking for a research mentor is early in the previous spring

semester. Do not wait until the registration period for the fall semester. If you want to start research in the spring semester, a good time to start looking for a research mentor is early in the fall semester. *There are a limited number of positions for students to do laboratory research and these positions fill up fast!*

Students are strongly encouraged (but not required) to begin some research before their Senior year (usually no more than 6 credits total). Indeed, Sophomore year is an ideal time to begin searching for a laboratory.

All research courses are by Departmental permission only. The *Research Approval Form* can be obtained from the Departmental website:

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/student-forms>

This form requires basic information, a research title, an abstract, and the signature of the research mentor. When completed, the student should present the form to his or her Genetics advisor for final approval. After this final signature is obtained, it can be taken to the Undergraduate Education Office (Nelson B-416) for the issuance of a special permission number to register for the course. The original approval form will be placed in the student's file. A new approval form and research description is required for each semester of research.

Finally, please note that faculty members are not obligated to keep a student doing research in their lab for more than 6 credits.

X. Research – Requirements and Expectations

Prerequisites

It is the responsibility of the student to find an advisor for his/her Research or Independent Study. Research requires a heavy commitment of time and effort on the part of the student, and can impact the performance in coursework for students who have not yet managed the foundational material for the discipline. Therefore, there is **a minimum GPA requirement of 2.80 for Research in Genetics (447:406-407)**.

There is no GPA requirement for *Advanced Independent Study in Genetics* (see below). However, it is the responsibility of the student to find a sponsor.

If a student is unable to find a Research or Advanced Independent Study, it will not be possible to complete the major. In such a case, please make an appointment with the Vice Chair (rongo@waksman.rutgers.edu) who will discuss various options.

Registering for Research

To register, students should complete a *Research Approval Form* from the Department website (<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/student-forms>). Please note that all Research courses now use a single form for registration. Students will need to provide their contact information, their GPA, and the name and contact information of their research mentor. Students will need to show that they have completed any necessary safety training and eCOI. Students will also need to provide a brief description of their proposed project. A detailed Project Overview (described below) will be required before the end of the add-drop period of the semester.

Students performing *Honors in Genetics* will need to register for 447:414-415 *Thesis Writing and Communication* concurrent with the semesters in which they perform their Honors research. All other students will be required to take 447:430 *Effective Communications in Genetics* after having completed one or more semesters of research for credit.

As mentioned, students will need to submit a separate Project Overview for registration (required even if the research is continuing). This must include a project title and a typed, double-spaced statement describing the project. Your research mentor must read and approve this statement before you submit it. Please include a brief history of the study, the methods that you will use, and your goals. Describe any preliminary work you have done for the proposal. Your proposal should be at least two pages in length. It should provide a brief synopsis of the present state of knowledge in the area in which you will be working, and it should detail why your study will contribute to the advancement of our understanding beyond the present level. References should be included, and must be cited in an appropriate scholarly fashion.

The Project Overview should also include a statement about previous research experience. Please list the course numbers, the number of credits, and the semesters in which previous research was conducted. Please indicate the research mentor and if your project includes interviewing, surveying, observing, sampling, or testing people. If so, you must obtain clearance from the Office of Research & Sponsored Programs; discuss with your research mentor how to do this. Please indicate if your project includes vertebrate animals. If so, you must be added to your research mentor's animal research protocol. Please indicate if and when you received safety training from REHS (all students conducting *Research in Genetics* in a lab at Rutgers must attend an REHS Laboratory Safety Training prior to commencing research in the lab. More information can be obtained at http://rehs.rutgers.edu/rehs_train.html#labsafety).

Expectations of the Research Student

To make the experience worthwhile for both the student and the research mentor, we expect the student to commit a sizable amount of time to the Research course. The Research course is not, and should not, be "an easy A" course. On average, the student should expect to spend between 3 to 5 hours a week *per credit* in the lab during the Fall or Spring semesters (information about summer research is below). Thus, for a typical three-credit course, students would be expected to work 12-15 hours per week. During this period, the student will be expected to be in the lab conducting experiments, organizing their data, reading about their research project, attending lab functions and meetings, and completing reports and their research paper.

Please note that students taking research for credit may not receive financial compensation from their research mentor's grants or from University fellowships (e.g., SURF, Aresty Research Assistant Program, et cetera) for the same effort in the lab, even if the work seems unrelated. Students may accept fellowships for courses taken for credit if all of the funds from the fellowship are supplied to the mentoring laboratory to cover the costs of supplies for the student's research (e.g., the Aresty fellowship program).

Guidelines for Research in Genetics (447:406-407)

Research in Genetics (447:406-407) is intended to provide students with an opportunity to engage in original laboratory research under the direct supervision of a faculty mentor, usually in the faculty member's research laboratory. Each student is expected to carry out his or her own research project. This course is available only to Genetics majors (3-6 credits per semester). **A GPA of 2.8 or better is required to register for these courses.** Registration is by Departmental permission only (see section VIII above for details).

A **written research paper** in the format of a scientific paper is required at the end of each semester. The research paper should include an Introduction, Materials and Methods, Results (data should be presented in figure and/or tabular form), Discussion, and References. **In general, we require a minimum of 10 pages for a one, two or three credit course** (double spaced, no larger than 12 pt. font). When registering for more than three credits, students are expected to write an additional **3 pages per credit** above the minimum 10-page paper. Please consider these page guidelines as **rock-bottom** minimums. Your report needs to be long enough to get the job done and to satisfy your research mentor. If in doubt, you should ask your research mentor for his or her expectations.

Research in Genetics can be used to fulfill the SAS core requirement in **Information Technology and Research (ITR)**. You must submit with your final paper a list of the technologies that you used. These technologies can be lab procedures, computer programs, or mining data from large databases.

You should submit a draft of your report to your research mentor well in advance of the due date, so he or she can make corrections and give you suggestions. Let your research mentor know your time schedule. The report for subsequent semesters does not need to be completely different from the first semester report if the student is continuing the project (i.e., much of the Introduction and Methods sections can simply be updated).

The paper is a major part of the grade and must be written in the student's own words. Avoid extensive quotes and paraphrases. Papers that are not original may be rejected (see below). All papers will be checked with TURNITIN.

An electronic copy of the paper must be uploaded to the SAKAI (<https://sakai.rutgers.edu/portal/>) site for Research in Genetics for that particular semester. Papers may be submitted in either **.doc**, **.pdf**, or plain text (**.txt**) formats. The *Submission Title* for your paper should be your name, the course number, and RUID. For example, **Gregor Mendel 406 RUID 301001121**. Do not use titles such as "Research report." We will download the final paper from the email for our archives, and we need each paper to be easily identified.

Your grade will be based on your laboratory performance and participation, as well as on your paper. The research mentor must grade the research paper and submit a final grade. Please ask your research mentor to submit a final grade for your research by the first day of exams. The research paper is due by **the first day of final exams by 11:30 AM**. If a grade is not received by this time, you will receive a grade of NG on your transcript. It is the responsibility of the student to know the due date. Do not expect reminders to come from the Department.

The Research Mentor should email the grade recommendation to the Vice Chair (rongo@waksman.rutgers.edu).

Guidelines for Research in Genetics – Writing Intensive (447:410)

Research in Genetics – Writing Intensive (447:410), in addition to providing students with a research project in the laboratory of a faculty member, also provides students with intensive instruction in writing a scientific paper in Genetics. Furthermore, it fulfills the writing and communication requirements of the SAS Core Curriculum. Prerequisites: 447:302, 447:315, or permission of the department. Registration by special permission only. **Cumulative grade-point average of 2.8 or better**. Open only to declared Genetics major.

This course may not be offered by many professors so check with your research mentor. This is a writing intensive course. Students will submit drafts of various sections of the paper throughout the semester (a minimum of two rough drafts).

Guidelines For Summer Research Courses (447:406-407)

Research in Genetics is intended to be an engaging educational experience – it is not a requirement to be rushed. Students are expected to conduct their research project over a period of one academic year or more. However, we understand that for scheduling reasons some students might wish to conduct research *for credit* during the summer. While the department generally discourages research *for credit* during the summer, we do accept it if the student either conducted research in the same lab the previous Spring semester or is going to continue in the same lab in the subsequent Fall semester. **A GPA of 2.8 or better is required to register for this course.**

The Department of Genetics usually offers *Research in Genetics* 447:406 and 447:407 in the summer. To take either of these courses, a student must be a declared Rutgers University Genetics major. A student may register for 3 credits for the entire summer [typically from the end of May to the middle of August – check the academic calendar (<http://summersession.rutgers.edu>) for specific dates]. Students may not travel or study abroad during this period. The maximum number of credits over the entire summer is three.

Students often ask, “What is the actual in-lab time commitment for summer research?” This calculation is a bit complicated because the length of the summer semester is condensed to 12 weeks (compared to 15 weeks in the regular year). Based on the notion that 1 credit hour of research requires 3 to 5 hours of lab time per week in the normal school year, it would be expected that 4 to 6 hours per week of in-lab time would be anticipated for 1 credit of research for the entire summer school session (or about 12 to 18 hours per week for 3 credits over the entire summer). You should consider this a minimum. This calculation does not include time spent outside the laboratory reading background papers, writing reports, etc. Because of the intensive nature of summer lecture courses, it would be extremely difficult to take courses in addition to *Research in Genetics* during the summer. Therefore, the department will not permit students to take Research in Genetics 447:406 or 447:407 concurrent with any other summer

course.

A research paper for any summer research session is due uploaded to SAKAI on the Monday of the last week of summer classes. This date usually falls in mid-August. This paper covers the full summer and has the same expectations and requirements as the paper required during the normal semester version of the course. In addition, please ask your research mentor to submit a grade no later than the last day of class. (The Summer School requires all grades no later than the last day of summer classes).

Please note that students taking research for credit during the summer may not receive financial compensation from their research mentor's grants or from University fellowships (e.g., SURF, Aresty Research Assistant Program, et cetera) for the same summer effort in the lab, even if the work seems unrelated. Students may accept fellowships for courses taken for credit if all of the funds from the fellowship are supplied to the mentoring laboratory to cover the costs of supplies for the student's research (e.g., the Aresty fellowship program).

Also note that summer research is not free. Students need to pay by the credit hour.

Students who wish to take *Research in Genetics* during the summer need to complete the same registration form as for during the normal semester:

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/student-forms>

However, summer research must be approved by the Vice Chair (rongo@waksman.rutgers.edu).

It is the policy of the Division of Life Sciences that research for credit may not be done during winter session. There are no exceptions.

Guidelines for Genetic Counseling Rotation (447:488)

This course is reserved for students accepted into the undergraduate Genetic Counseling Certificate Program (GCCP) within the Department of Genetics. Students will meet weekly with the GCCP director and attend a rotation at a local Genetic Counseling clinic. At the clinic, students will observe counseling sessions, perform literature searches, observe weekly clinical and ultrasound meetings, assist with chart preparation, and prepare case-summary write-ups. During the weekly meetings students will discuss and present the medical and ethical issues of the cases that they observed in their clinic rotation. **A GPA of 2.8 or better is required to register for this course.** Registration by special permission only. For more information please contact Dr. Gary Heiman (Heiman@biology.rutgers.edu).

Guidelines for Advanced Independent Study in Genetics (447:489-490)

Advanced Independent Study is intended to provide motivated students with the opportunity to do scholarship in genetics under the supervision of a faculty member. This scholarship is flexible and might include internships, development of informational websites, and creation of teaching modules or extensive literature reviews. Students in *Advanced Independent Study* must produce a written report (thesis, informational website, etc.) to be graded by their faculty mentor, similar to regular research in Genetics. Pre- or corequisite: 01:447:384.

Guidelines for Honors in Genetics (447:408-409)

Honors in Genetics (447:408-409) is intended to provide highly motivated Seniors with an opportunity to immerse themselves in an original scientific research project. Honors students must complete at least 12 credits of research in a single laboratory, at least 6 of which must be at Honors level (i.e., 447:408-409). Students engage in laboratory research under the direct supervision of a faculty mentor. Each student is expected to carry out his or her own research project. These courses are available only to Senior majors (3-6 credits per semester), and require an **overall GPA of 3.4 or better**, and an average GPA of 3.4 or better in courses credited towards the major. Students must submit a completed *Research Approval Form*, which can be downloaded from the Department website (<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/student-forms>), to the Undergraduate Office. *Honors in Genetics* requires approval from the Departmental Vice Chair (rongo@waksman.rutgers.edu)

Honors in Genetics 447:408-409 is required to qualify for Departmental Honors (for alternative School-Based Honors please see Section X, Honors). Concurrent registration in 447:414 and 447:415 (*Honors Thesis Writing*) is required. *Honors in Genetics* will count towards the SAS Honors Program capstone event. Alternatively, students may register in a college Honors Program course, but cannot receive credit for both *Honors in Genetics* and their college Honors Program course for the same research.

A preliminary thesis containing the Introduction and Materials and Methods sections is due at the end of the first semester. A short summary of any research results (data should be presented in figure and/or tabular form), discussion, and references is also recommended as part of this draft. The form of the Introduction and Materials and Methods will be guided by the instructor in *Thesis and Communication in Genetics* 447:414. You **must** submit a draft of your preliminary thesis to your research mentor *at least seven (7) days* before the due date, so he or she can make corrections and give you suggestions. Let your research mentor know your time schedule.

The preliminary thesis is due on the first day of final exams or when required in 447:414. Your

grade will be based on your laboratory performance and participation, as well as on your paper. You should ask your research mentor to submit a final grade for your research by the first day of final exams. The grade recommendation should be submitted to the Vice Chair (rongo@waksman.rutgers.edu). You will receive additional information in the second semester regarding your final thesis and oral presentation.

Students must submit their final written thesis at the end of the second semester accompanied by an oral presentation and thesis-defense (these requirements usually need to be completed by the first week of April for a May graduation – please check <https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/departamental-awards-honors> for specific dates). The thesis committee should be composed of at least three faculty members, including the research mentor. At least one Genetics Department faculty member must serve on the thesis committee. Registration is by Departmental permission only (see section VII above for details). Thesis guidelines are available on the Department website at the link mentioned above.

The student is expected to work with his or her advisor throughout the semester to produce the written thesis. A copy of your completed thesis must be submitted to every member of your committee at least one week before the final defense. Your advisor may require a copy much earlier than this. Talk with your research mentor.

Students who were previously placed on Disciplinary Probation (as defined in the University Code of Student Conduct <http://studentconduct.rutgers.edu/university-code-of-student-conduct>) will be ineligible to register for Honors in Genetics. A student placed on Disciplinary Probation while completing their thesis research will be removed from Departmental Honors as according to University Policy.

Travel Stipends

Genetics Majors engaged in independent research are eligible to apply for a Departmental travel stipend to attend a scientific meeting if they are the first author of a presentation. If approved, the Department of Genetics will provide up to \$500.⁰⁰ in matching funds. The award requires that at least 50% of the total meeting costs come from another source (e.g., the student's research mentor). Interested students and their research mentor should apply to the Vice Chair (rongo@waksman.rutgers.edu), and they should indicate the source of the matching funds, provide the name and dates for the specific meeting, and submit a meeting abstract (including title, all authors, and the research summary).

XI. Honors Guidelines

Departmental Honors Program

In order to qualify, by the end of the junior year a student must have a cumulative grade-point average of 3.4 or better, and an average of 3.4 or better in Life Sciences courses credited toward one of the Departmental majors. At that time, the student should formally apply to the Department to complete at least six (6) credits of *Honors in Genetics* (447:408-409) out of the total of 12 research credits required for Honors, resulting in a thesis. They must also pass an oral examination before a faculty committee in the general field of the student's program of emphasis. Please see the previous section for more details. To apply, students should complete the *Research Approval Form* and check the Honors course. The form is available at <https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/student-forms>

Guidelines for College Honors Research

An SAS student eligible for Departmental Honors will be designated as an SAS Paul Robeson Scholar. Some students may opt to complete a SAS Interdisciplinary Honors Thesis (090:493,494). Information about the SAS Interdisciplinary Honors Thesis may be found online at <http://sasundergrad.rutgers.edu/academics/additional-academic-programs/thesis-programs>. Please contact Dean Muffin Lord at lord@sas.rutgers.edu or 848-932-7964 for more information about SAS Interdisciplinary Honors Thesis.

Students doing an SAS Interdisciplinary Honors Thesis might also qualify for Departmental Honors. See the Vice Chair (rongo@waksman.rutgers.edu) for details about this or other options for SAS Honors.

Appropriate Honors Courses Include:

- 01:447:408-409 Honors in Genetics (3-6, 3-6)
- 11:015:497-498 George H. Cook (3-6, 3-6)
- 01:090:495-496 SAS Honors Interdisciplinary Thesis (3, 3) *

Students may not register for more than one of these courses in a given semester. Completed research studies can only be used to complete one of these options.

Students must also complete **Honors Thesis and Communication in Genetics** 447:414 and 415** in order to qualify for departmental Honors. These courses should be taken concurrently with 447:408-409, 015:497-498, or 01:090:495-496.

*Must have completed an additional 6 credits of research relevant to the final thesis.

** The SAS course 01:090:491-492, *Research Workshop*, will **not** substitute for 447:414-415.

XII. The SAS Core Curriculum and The Genetics Major

The Core Curriculum of SAS establishes common goals that, along with a major specialization, prepare graduates for successful lives and careers. For more information about the SAS Core, please see <http://sasundergrad.rutgers.edu/academics/requirements/core>. Students should note that because of the credit-intensive requirements of our Department's curriculum, Genetics majors are exempt from the SAS requirement of a specialized minor. In addition, several courses within the major satisfy learning goals of the SAS Core Curriculum:

1. Goals: 21st Century Challenges [21C]

Students take two courses (at least 6 credits) that meet at least two of these four goals:

- Analyze the degree to which forms of human difference shape a person's experiences of and perspectives on the world.
- Analyze a contemporary global issue from a multidisciplinary perspective.
- Analyze the relationship that science and technology have to a contemporary social issue.
- Analyze issues of social justice across local and global contexts.

The 21st Century Challenge Learning Goal must be fulfilled by taking classes at Rutgers-New Brunswick; transfer and AP courses are not certified to meet these learning goals.

Genetics courses meeting this goal:

- *Genetic Analysis I* (447:384)
- *Social, Ethical and Legal Implications of the New Genetics* (447:354)
- *Evolutionary Medicine* (447:356)

2. Goals: Areas of Inquiry

- **Natural Sciences [NS]**
 - Met by introductory life science courses (e.g., *General Biology* 115-116)
- **Social and Historical Analysis [SCL], [HST]**
 - Not met in major
- **Arts and Humanities [AH]**
 - Not met in major

3. Goals: Cognitive Skills and Processes

3.A. Writing and Communication [WC], [WCr], [WCd]

Students take three courses (at least 9 credits), including Expository Writing (01:355:101), one WCr, and one WCd, and, in doing so, meet all five goals:

- Communicate complex ideas effectively, in standard written English, to a general audience.
- Respond effectively to editorial feedback from peers, instructors, and/or supervisors through successive drafts and revision. [WCr]
- Communicate effectively in modes appropriate to a discipline or area of inquiry. [WCd]
- Evaluate and critically assess sources and use the conventions of attribution and citation correctly.
- Analyze and synthesize information and ideas from multiple sources to generate new insights.

Genetics Courses Meeting the WC Goals

- *Effective Communication Skills in Genetics* (447:430) [WCr] [WCd]
- *Research in Genetics Writing Intensive* (447:410) [WCr] [WCd]
- *Cancer* (447:495) [WCd]
- *Thesis Writing and Communication in Genetics* (447:414, with concurrent registration in 447:408) [WCr]
- *Thesis Writing and Communication in Genetics* (447:415, with concurrent registration in 447:409) [WCd]

3.B. Quantitative and Formal Reasoning [QQ], [QR]

Students take two courses (at least 6 credits) and meet both goals:

- Formulate, evaluate, and communicate conclusions and inferences from quantitative information. [QQ]
- Apply effective and efficient mathematical or other formal processes to reason and to solve problems. [QR]

Genetics Curriculum Requirements Meeting the QQ/QR Goals

This goal is met by the current requirement of two calculus courses, or one calculus course and statistics (960:401).

3.C. Information Technology and Research [ITR]

Students take one course (at least 3 credits) and, in doing so, meet at least one of these three goals:

- Employ current technologies to access information, to conduct research, and to communicate findings.
- Analyze and critically assess information from traditional and emergent technologies.
- Understand the principles that underlie information systems.

Genetics Curriculum Requirements Meeting ITR Goals

- *Introduction to Research in Genetics* (447:315)
- *Introduction to Research in Molecular Biology* (694:214)
- *Honors Introduction to Research in Molecular Biology* (694:215)
- *Quantitative Biology and Bioinformatics* (447:302)
- *Research in Genetics* (447:406-407) or *Honors in Genetics* (447:408-409)

Summary of courses that meet SAS Core requirements and/or Honors requirements:

Course	Number and Credits	SAS Req.
<i>Anal Sci Lit</i>	447:216 (3 cr.)	H
<i>Impl New Genetics</i>	447:354 (3 cr.)	21C (goal c)
<i>Evol Medicine</i>	447:356 (3 cr.)	21C (goal c)
<i>Cancer</i>	447:495 (3 cr.)	WCd (goals t, u, v)
<i>Quant Biol and Bioinfo</i>	447:302 (3 cr.)	ITR (goals y, z)
<i>Intro to Research</i>	447:315 (3 cr.)	ITR (goals y, z)
<i>Genetic Analysis I</i>	447:384 (4 cr.)	21C (goal c), H*
<i>Genetic Analysis II</i>	447:385 (4 cr.)	H*
<i>Thesis Wri and Com</i>	447:414 (1.5 cr.)	WCr (goals s-2, u, v)
<i>Thesis Wri and Com</i>	447:415 (1.5 cr.)	WCd (goals s-1, t, u, v)
<i>Effective Comm</i>	447:430 (3 cr.)	WCr, WCd (goals s-1, s-2, t, u, v)
<i>Res in Genetics</i>	447:406-407 (3,3 cr.)	ITR (goals y, z)
<i>Honors Genetics</i>	447:408-409 (3-6, 3-6 cr.)	H, ITR (goals y, z)
<i>Res in Gen –Writing</i>	447:410 (3 cr.)	WCr, WCd (goals s-1, s-2, t, u, v)

**Only the Honors section of Genetic Analysis I and II will count towards fulfilling honors course requirements within the SAS Honors Program or the Honors College.*

XIII. Genetics Department Awards to Graduating Seniors

In May, the Department of Genetics announces Awards for Undergraduate Majors in Genetics who are graduating at the end of the Spring semester. For additional information on any of the awards, contact Dr. Mary Konsolaki (konsolaki@biology.rutgers.edu).

The Duncan And Nancy Macmillan Award For Research Excellence

This award recognizes a graduating Senior who has demonstrated outstanding accomplishment in research by the completion of a project of publication quality.

To receive this award, the student must submit an application, which includes:

1. A description of the student's research accomplishments
2. A letter of recommendation from the student's research mentor
3. An oral presentation of the research project at the Departmental Honors Day Symposium (typically held during the first week in April)

An application for this award can be found here:

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/departmental-awards-honors>

The application is typically due around the first week of April. Check the department website in Spring for the exact date.

The Howard C. Passmore Award For Distinguished Academic Achievement

This award recognizes a graduating Senior who has demonstrated outstanding achievement in academic coursework, participation in research, and commitment to service. To receive this award, the student must submit an application, which includes:

1. A transcript of courses, including any courses taken at other academic institutions
2. A statement of research accomplishments
3. A detailed description of service activities at Rutgers University and/or the community at large

An application for this award can be found here:

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/departmental-awards-honors>

The application is typically due around the first week of April. Check the department website in Spring for the exact date.

The Department Of Genetics Award For Excellence In A Research Presentation

This award is presented to a graduating Senior who shows extraordinary skills in scientific communication to an audience of peers at the Departmental Honors Day (held during the first week in April). All students participating in Honors Day Presentations are automatically considered for this award.

Additional Information, including previous award winners and application materials, can be obtained here:

<https://www.sas.rutgers.edu/cms/genetics/academics/undergraduate/departmental-awards-honors>

XIV. Association of Undergraduate Geneticists (AUG)

The Association of Undergraduate Geneticists (AUG) is a club for any undergraduate student who is interested in the field of Genetics. The primary goal of the AUG is to serve as an educational and social environment for its members. The Association works closely with the Rutgers Genetics Department in an effort to update the students on research opportunities, seminars of interest, and various other Departmental activities. The AUG itself also invites guest speakers who share their knowledge, expertise, and views on the science of Genetics as it relates to philosophy, politics and policy-making, religion, etc.

Apart from lectures and seminars, student interaction is encouraged through movie nights, trips and many more, as yet undecided activities. We always look forward to thoughts and ideas from our student-members. The AUG is an exciting and expanding group of young scientists and the Association invites and welcomes any suggestions!

The AUG also offers experienced student mentors to assist freshmen, sophomore and even junior students. These mentors can offer valuable “inside” information pertaining to the Genetics major, for example, classes and professors. This “inside” information is viewed from a perspective of current students who have already experienced the different processes involved. The following is a listing of AUG Officers:

President:	Shveta Parekh	svp53@scarletmail.rutgers.edu
Vice President:	Francesca Spinosi	f.m.spinosi@gmail.com
Treasurer:	Muhammed Rahim	falirhim12@gmail.com
Secretary:	Adiba Salim	adibasalim12@gmail.com
PR Chair:	Tania Atanassova	tja59@scarletmail.rutgers.edu

Please don't hesitate to contact any AUG Officer, or visit the websites:

<https://www.facebook.com/RutgersAUGOfficial/?fref=ts>

XV. Academic Integrity

The Faculty of the Department of Genetics are committed to teaching Genetics from an interactive, research perspective. In many courses, you will be evaluated using take-home, open-book tests and papers. Perhaps the most serious error that a researcher can commit is to fabricate his or her data. We expect our students to be honest, not to cheat or plagiarize. Therefore, if a student violates academic integrity, he or she will *immediately* be reported to the appropriate Dean for disciplinary action.

The following is the official Rutgers policy on academic integrity:

<http://academicintegrity.rutgers.edu/>

XVI. Courses Offered By the Department of Genetics

Note: Many courses are offered during only ONE (1) SEMESTER. Some are offered EVERY OTHER YEAR. Credits are listed in parentheses.

01:447:201	<i>Independent Study in Genetics (1-3) - Fall</i>
01:447:202	<i>Independent Study in Genetics (1-3) – Spring</i>
01:447:216	<i>Analysis of Scientific Literature (3) – Spring</i>
01:447:245	<i>Introduction to Cancer (3) – Both semesters</i>
01:447:302	<i>Quantitative Biology and Bioinformatics (3) – Spring</i>
01:447:315	<i>Introduction to Research in Genetics (3) – Spring</i>
01:447:352	<i>Genome Evolution (3) – Fall</i>
01:447:354	<i>Social, Legal and Ethical Issues of the New Genetics (3) – Fall</i>
01:447:370	<i>Developmental Genetics (3) – Spring</i>
01:447:380	<i>Genetics (4) - Both semesters</i>
01:447:382	<i>Genetics Laboratory (1) – Both semesters</i>
01:447:384	<i>Genetic Analysis I - Fall only</i>
01:447:385	<i>Genetics Analysis II - Spring</i>
01:447:390	<i>General Microbiology - (4) Both semesters</i>
01:447:392	<i>Pathogenic Microbiology (3) – Summer session</i>
01:447:406	<i>Research in Genetics - Fall & Summer</i>
01:447:407	<i>Research in Genetics - Spring</i>
01:447:408	<i>Honors in Genetics - Fall</i>
01:447:409	<i>Honors in Genetics - Spring</i>
01:447:414	<i>Thesis and Communication in Genetics (1.5) – Fall</i>
01:447:415	<i>Thesis and Communication in Genetics (1.5) – Spring</i>
01:447:430	<i>Effective Communication Skills in Genetics (3) - Both semesters</i>
01:447:460	<i>Genetics of Compulsive Behavior (3) - Spring</i>
01:447:465	<i>Mutant Isolation and Analysis (3) – Fall</i>
01:447:478	<i>Special Topics in Genetics (3) - Offered irregularly</i>
01:447:479	<i>Special Topics in Genetics (3) - Offered irregularly</i>
01:447:481	<i>Topics in Human Genetics (3) – Fall</i>
01:447:484	<i>Behavioral and Neural Genetics (3) – Spring</i>
01:447:486	<i>Evolutionary Genetics (3) – Fall</i>
01:447:488	<i>Genetic Counseling Rotation (3) – Both semesters & Summer</i>
01:447:489	<i>Advanced Independent Study in Genetics (3) – Fall</i>
01:447:490	<i>Advanced Independent Study in Genetics (3,3) – Spring</i>
01:447:495	<i>Cancer (3) – Fall</i>

XVII. Example Pathways Towards Completing the Genetics Major

Here we present some example pathways by which a student can complete the Genetics major. Many additional paths to achieve the major are also possible. Consult your advisor.

Example 1: Standard Pathway, No AP Credit

- **Freshman Year**
 - *Fall*
 - 01:119:115 (General Bio I, 4 cr)
 - 01:160:161 (General Chemistry I, 4 cr)
 - 01:640:135 (Calc I, 4 cr)
 - *Spring*
 - 01:119:116 (General Bio II, 4 cr)
 - 01:119:117 (General Bio Lab, 2 cr)
 - 01:160:162 (General Chemistry II, 4 cr)
 - 01:160:171 (Intro to Experimentation, 1 cr)
 - 01:640:401 (Basics Stats for Research, 3 cr)
- **Sophomore Year**
 - *Fall*
 - 01:750:203 (General Physics I, 3 cr)
 - 01:750:205 (General Physics Lab I, 1 cr)
 - 01:160:307 (Organic Chem I, 4 cr)
 - 01:447:384 (Genetic Analysis I, 4 cr)
 - *Spring*
 - 01:750:204 (General Physics II, 3 cr)
 - 01:750:206 (General Physics Lab II, 1 cr)
 - 01:160:308 (Organic Chem II, 4 cr)
 - 01:447:385 (Genetic Analysis II, 4 cr)
- **Junior Year**
 - *Fall*
 - 01:694:407 (Biochemistry, 3 cr)
 - Genetics Elective (3 cr, See list on page 13)
 - *Spring*
 - 01:447:407 (Research in Genetics, 3 cr)
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:315 (Intro to Research in Genetics, 3 cr)
- **Senior Year**
 - *Fall*
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:430 (Eff Comm Skills Genetics, 3 cr)
 - 01:447:406 (Research in Genetics, 3 cr)
 - *Spring*
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:407 (Research in Genetics, 3 cr)
 - 01:160:311 (Organic Chem Lab, 2 cr)

Example 2: Standard Pathway, AP Credit for General Biology

- **AP Credit**
 - *Biology*
 - 01:119:115 (4 cr)
 - 01:119:116 (4 cr)
 - 01:119:117 (2 cr)
- **Freshman Year**
 - *Fall*
 - 01:160:161 (General Chemistry I, 4 cr)
 - 01:640:135 (Calc I, 4 cr)
 - *Spring*
 - 01:160:162 (General Chemistry II, 4 cr)
 - 01:160:171 (Intro to Experimentation, 1 cr)
 - 01:640:401 (Basics Stats for Research, 3 cr)
 - 01:750:203 (General Physics I, 3 cr)
 - 01:750:205 (General Physics Lab I, 1 cr)
- **Sophomore Year**
 - *Fall*
 - 01:750:204 (General Physics II, 3 cr)
 - 01:750:206 (General Physics Lab II, 1 cr)
 - 01:160:307 (Organic Chem I, 4 cr)
 - 01:447:384 (Genetic Analysis I, 4 cr)
 - *Spring*
 - 01:160:308 (Organic Chem II, 4 cr)
 - 01:447:385 (Genetic Analysis II, 4 cr)
 - 01:447:315 (Intro to Research in Genetics, 3 cr)
- **Junior Year**
 - *Fall*
 - 01:447:406 (Research in Genetics, 3 cr)
 - 01:160:311 (Organic Chem Lab, 2 cr)
 - 01:694:407 (Biochemistry, 3 cr)
 - *Spring*
 - 01:447:407 (Research in Genetics, 3 cr)
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:430 (Eff Comm Skills Genetics, 3 cr)
- **Senior Year**
 - *Fall*
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:406 (Research in Genetics, 3 cr)
 - *Spring*
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:407 (Research in Genetics, 3 cr)

Example 3: Honors Pathway, Extensive AP Credit

- **AP Credit**
 - *Biology*
 - 01:119:115 (4 cr)
 - 01:119:116 (4 cr)
 - 01:119:117 (2 cr)
 - *Chemistry*
 - 01:160:161 (4 cr)
 - 01:160:162 (4 cr)
 - 01:160:171 (2 cr)
 - *Calculus*
 - 01:640:151 (4 cr)
 - 01:640:152 (4 cr)
- **Freshman Year**
 - *Fall*
 - 01:694:215 (Honors Intro to Research, 3 cr)
 - 01:750:203 (General Physics I, 3 cr)
 - 01:750:205 (General Physics Lab I, 1 cr)
 - *Spring*
 - 01:750:204 (General Physics II, 3 cr)
 - 01:750:206 (General Physics Lab II, 1 cr)
- **Sophomore Year**
 - *Fall*
 - 01:447:406 (Research in Genetics, 3 cr)
 - 01:160:307 (Organic Chem I, 4 cr)
 - 01:447:384 (Genetic Analysis I, 4 cr)
 - *Spring*
 - 01:447:407 (Research in Genetics, 3 cr)
 - 01:160:308 (Organic Chem II, 4 cr)
 - 01:447:385 (Genetic Analysis II, 4 cr)
- **Junior Year**
 - *Fall*
 - 01:447:406 (Research in Genetics, 3 cr)
 - 01:160:311 (Organic Chem Lab, 2 cr)
 - 01:694:407 (Biochemistry, 3 cr)
 - *Spring*
 - 01:447:407 (Research in Genetics, 3 cr)
- **Senior Year**
 - *Fall*
 - 01:447:408 (Honors in Genetics, 6 cr)
 - 01:447:414 (Thesis Writing & Communication in Genetics, 1.5 cr)
 - Genetics Elective (3 cr, See list on page 13)
 - *Spring*
 - 01:447:409 (Honors in Genetics, 6 cr)
 - 01:447:415 (Thesis Writing & Communication in Genetics, 1.5 cr)
 - Genetics Elective (3 cr, See list on page 13)

Example 4: Genetic Counseling Pathway with AP Biology

- **AP Credit**
 - *Biology*
 - 01:119:115 (4 cr)
 - 01:119:116 (4 cr)
 - 01:119:117 (2 cr)
- **Freshman Year**
 - *Fall*
 - 01:160:161 (General Chemistry I, 4 cr)
 - 01:640:135 (Calc I, 4 cr)
 - *Spring*
 - 01:160:162 (General Chemistry II, 4 cr)
 - 01:160:171 (Intro to Experimentation, 1 cr)
 - 01:640:401 (Basics Stats for Research, 3 cr)
 - 01:750:203 (General Physics I, 3 cr)
 - 01:750:205 (General Physics Lab I, 1 cr)
- **Sophomore Year**
 - *Fall*
 - 01:750:204 (General Physics II, 3 cr)
 - 01:750:206 (General Physics Lab II, 1 cr)
 - 01:160:307 (Organic Chem I, 4 cr)
 - 01:447:384 (Genetic Analysis I, 4 cr)
 - *Spring*
 - 01:160:308 (Organic Chem II, 4 cr)
 - 01:447:385 (Genetic Analysis II, 4 cr)
 - 01:447:302 (Quantitative Biology & Bioinformatics, 3 cr)
- **Junior Year**
 - *Fall*
 - 01:447:406 (Research in Genetics, 3 cr)
 - 01:160:311 (Organic Chem Lab, 2 cr)
 - 01:694:407 (Biochemistry, 3 cr)
 - *Spring*
 - 01:447:488 (Genetic Counseling Rotation, 3 cr)
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:430 (Eff Comm Skills Genetics, 3 cr)
- **Senior Year**
 - *Fall*
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:406 (Research in Genetics, 3 cr)
 - *Spring*
 - Genetics Elective (3 cr, See list on page 13)
 - 01:447:407 (Research in Genetics, 3 cr)