

Integrative Genetics and Genomics BS

Overview

The **Bachelor of Science in Integrative Genetics and Genomics**, offered by the Department of Biology, is designed to meet the growing need for professionals who can seamlessly combine classical molecular and cell biology knowledge with advanced data science skills. This innovative curriculum is structured around two main pillars: the computational biology skill set necessary for accessing and processing large datasets, and a rigorous molecular biology knowledge base to interpret and derive meaningful insights from the data.

Students will begin their academic journey by establishing a solid foundation in Chemistry, Biology, and Mathematics. As they progress, they will have the opportunity to specialize in either Molecular Cell Biology or Genetics. A distinctive feature of this program is the requirement for all students to engage in a minimum of two semesters of undergraduate research, providing hands-on experience and practical application of their skills. Graduates of this program will be highly competitive for positions in academia, industry, or government, and will be exceptionally well-prepared for top graduate and professional programs.

Campus Location: Main

Program Code: ST-IGG-BS

Distinction in Major

To graduate with distinction in this major, a student must satisfy the following criteria:

- achieve a minimum 3.2 cumulative GPA;
- achieve a minimum 3.2 major GPA;
- successfully complete BIOL 4391 Accelerated Research in Biology, BIOL 4291 Extradepartmental Research, or BIOL 4396 Advanced Study in Biology for a total of 6 credits over two semesters;
- write a final research paper; and/or
- present their research at a departmental research poster session.

Undergraduate Contact Information

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These requirements are for students who matriculated in academic year 2024-2025. Students who matriculated prior to fall 2024 should refer to the Archives to view the requirements for their Bulletin year.

Bachelor of Science Requirements

Summary of Requirements for the Degree

1. University Requirements

- Students must complete all University requirements including those listed below.
- All undergraduate students must complete at least two writing-intensive courses for a total of at least six credits at Temple as part of their major. The specific writing-intensive course options for this major are:

Code	Title	Credit Hours
BIOL 2297	Research Techniques in Genetics	3
BIOL 4396	Advanced Study in Biology	3

- Students must complete the General Education (GenEd) requirements.
 - See the General Education section of the *Undergraduate Bulletin* for the GenEd curriculum.
 - Students who complete CST majors receive a waiver for 2 Science & Technology (GS) and 1 Quantitative Literacy (GQ) GenEd courses.
 - Students must satisfy general Temple University residency requirements.
2. College Requirements
- A minimum of 90 total credits within the College of Science & Technology (CST), the College of Liberal Arts (CLA), and/or the College of Engineering (ENG).
 - A minimum of 45 of these credits must be upper-level (courses numbered 2000 and above).
 - Complete a one-credit first-year or transfer seminar.
 - SCTC 1001 CST First Year Seminar for every entering first-year CST student.
 - SCTC 2001 CST Transfer Seminar for every entering transfer CST student.

3. Major Requirements for Bachelor of Science (79-85 s.h.)

At least 9 courses required for the major must be completed at Temple. At least 6 Biology courses must be completed at Temple.

Code	Title	Credit Hours
Biology		
BIOL 1111 or BIOL 1911	Introduction to Organismal Biology Honors Introduction to Organismal Biology	4
BIOL 1112 or BIOL 1912	Introduction to Biomolecules, Cells and Genomes Honors Introduction to Biomolecules, Cells and Genomes	4
BIOL 2207	Genetics	3
BIOL 2297	Research Techniques in Genetics (WI) ¹	3
BIOL 3113	Genome Analytics	3
Select one of the following: ²		3-4
BIOL 3204	Cell Structure and Function (F)	
BIOL 3324	Molecular Biology	
BIOL 4375	General Biochemistry I	
BIOL 3403	Genomic Biology	3
Select one of the following:		3-4
BIOL 3514	Biological Models in Python	
CIS 1051	Introduction to Problem Solving and Programming in Python	
CIS 1057	Computer Programming in C	
BIOL 4396	Advanced Study in Biology	3
BIOL 4XXX		3
Chemistry		
Select one of the following:		4
CHEM 1031 & CHEM 1033	General Chemistry I and General Chemistry Laboratory I	
CHEM 1951 & CHEM 1953	Honors General Chemical Science I and Honors Chemical Science Laboratory I (F)	
Select one of the following:		4
CHEM 1032 & CHEM 1034	General Chemistry II and General Chemistry Laboratory II	
CHEM 1952 & CHEM 1954	Honors General Chemical Science II and Honors Chemical Science Laboratory II (S)	
Select one of the following:		4
CHEM 2201 & CHEM 2203	Organic Chemistry I and Organic Chemistry Laboratory I	
CHEM 2921 & CHEM 2923	Organic Chemistry for Honors I and Organic Honors Laboratory I (F)	

Select one of the following: 4

CHEM 2202 Organic Chemistry II
& CHEM 2204 and Organic Chemistry Laboratory II

CHEM 2922 Organic Chemistry for Honors II
& CHEM 2924 and Organic Honors Laboratory II (S)

College of Science and Technology

SCTC 1013 Elements of Data Science for the Physical and Life Sciences 3

Integrative Genetics and Genomics Electives

Select four from the following:^{3, 4, 5} 12-16

BIOL 2311 Human Evolution

BIOL 2812 Fundamentals of Medical Genetics

BIOL 3011 Integrative Cell and Tissue Biology

BIOL 3083 Directed Readings (With Approval from Program Director)

BIOL 3101 Evolution

BIOL 3112 Fundamentals of Genomic Evolutionary Medicine

BIOL 3114 Evolutionary Ecology

BIOL 3128 Genomics and Infectious Disease Dynamics

BIOL 3201 Human Genetics

BIOL 3212 Introduction to Bioinformatics and Computational Biology

BIOL 3204 Cell Structure and Function²

BIOL 3214 Theoretical Population Genetics

BIOL 3225 Evolutionary Genetics and Phylogenetics

BIOL 3232 Behavioral Genetics

BIOL 3241 Genomics and Evolutionary Biology of Parasites and Other Dependent Species

BIOL 3243 Parasitology

BIOL 3244 Experimental Marine Biology

BIOL 3245 Marine Ecology

BIOL 3254 Animal Behavior

BIOL 3265 Developmental Biology

BIOL 3268 Fundamentals of Cell and Cancer Biology

BIOL 3275 Ecology of Invasive Species

BIOL 3301 Advanced Cell Biology

BIOL 3307 Conservation Biology

BIOL 3312 Biostatistics

BIOL 3316 Tropical Marine Biology

BIOL 3317 General Microbiology

BIOL 3321 Plant Community Ecology

BIOL 3323 Global Change Science: Analytics with R

BIOL 3324 Molecular Biology²

BIOL 3327 Immunology

BIOL 3328 Virology

BIOL 3329 Developmental Genetics

BIOL 3334 Mammalian Physiology

BIOL 3335 Life at the Extremes - Polar Biology

BIOL 3336 Freshwater Ecology

BIOL 3352 Systems Neuroscience

BIOL 3354 Neural Basis of Animal Behavior

BIOL 3356 Organization and Development of the Nervous System

BIOL 3358 Cellular and Molecular Neuroscience

BIOL 3361 Molecular Neuropharmacology

BIOL 3363 Mammalian Development

BIOL 3364 Theory and Applications of Cancer Biology

BIOL 3365	The New Neuroimmunology	
BIOL 3368	Biology of Cancer	
BIOL 3369	Approaches to Disease Modeling, Diagnosis and Therapy	
BIOL 3371	Cell Proliferation	
BIOL 3372	The Molecular Regulation of Cell Migration and Morphogenesis During Development and Disease	
BIOL 3373	Cell Signaling	
BIOL 3379	Biotechnology	
BIOL 3380	Contemporary Biology (With Approval from Program Director)	
BIOL 3389	Field Research in Community Ecology	
BIOL 4327	Biological Impacts of Global Climate Change	
BIOL 4338	Epigenetics	
BIOL 4341	Genome Editing	
BIOL 4364	Biochemistry of Embryogenesis	
BIOL 4365	Evolutionary Developmental Biology: Evo-Devo	
BIOL 4366	Stem Cell Biology	
BIOL 4370	Advanced Special Topics in Biochemistry	
BIOL 4375	General Biochemistry I ²	
BIOL 4376	General Biochemistry II	
CHEM 3103	Analytical Chemistry	
CHEM 3105	Analytical Chemistry Lab	
CHEM 4201	Organic Structure and Mechanisms	
CHEM 4202	Organic Synthesis Methodology	
CHEM 4207	Synthesis and Identification of Organic and Medicinal Compounds	
CIS 2033	Computational Probability and Statistics	
CIS 2109	Database Management Systems	
CIS 2166	Mathematical Concepts in Computing II	
CIS 2168	Data Structures	
CIS 2229	Architecture, Operating Systems and Networking	
CIS 3203	Introduction to Artificial Intelligence	
CIS 3207	Introduction to Systems Programming and Operating Systems	
CIS 3217	Computer Architecture	
CIS 3223	Data Structures and Algorithms	
CIS 3715	Principles of Data Science	
CIS 3755	Introduction to Information Visualization	
CIS 4331	Principles of Database Systems	
CIS 4372	C++ Applications Programming	
CIS 4523	Knowledge Discovery and Data Mining	
CIS 4526	Foundations of Machine Learning	
MATH 2031	Probability and Statistics	
MATH 2101	Linear Algebra	
MATH 3031	Probability Theory I	
MATH 3032	Mathematical Statistics	
Mathematics		
MATH 1041	Calculus I	4
or MATH 1941	Honors Calculus I	
Select one of the following:		4
MATH 1042	Calculus II	
or MATH 1942	Honors Calculus II	
MATH 1044	Introduction to Probability and Statistics for the Life Sciences	
Physics		
Select one of the following:		4
PHYS 1021	Introduction to General Physics I	

PHYS 1061 or PHYS 1961	Elementary Classical Physics I Honors Elementary Classical Physics I
PHYS 2021 or PHYS 2921	General Physics I Honors General Physics I
Select one of the following:	
PHYS 1022	Introduction to General Physics II
PHYS 1062 or PHYS 1962	Elementary Classical Physics II Honors Elementary Classical Physics II
PHYS 2022 or PHYS 2922	General Physics II Honors General Physics II

Total Credit Hours **79-85**

Code	Title	Credit Hours
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(F) - Fall only course

(S) - Spring only course

- ¹ This course has a co-requisite of BIOL 2207.
- ² Only one of these courses (BIOL 3204, BIOL 3324, or BIOL 4375) need be selected to meet the requirement of the major. If additional courses from this group are taken they may be used to fulfill the requirement for upper-level electives.
- ³ Up to one (1) Elective (3-4 s.h.) may be replaced by a Cognate elective selected from the following: MATH 1042/MATH 1942; or MATH 2043/MATH 2943 (but only one of these math courses, and MATH 1042/MATH 1942 may only count if MATH 1044 is used to satisfy the second math course requirement in the major); or PHYS 2511 and PHYS 3511.
- ⁴ Students may fulfill one upper-level elective by completing a total of 6 credits of research. A maximum of 3 credits may come from the junior level research course BIOL 3082 and the remaining 3 credits must come from a senior level (**4000+**) research course. Students may also complete all 6 credits using two semesters of the senior research course if they prefer. Consult with your departmental advisor to determine which course(s) are appropriate. Once completed, students must seek approval from a CST advisor to obtain the waiver for credit towards one upper-level elective.
- ⁵ Note that some of the upper-level elective choices in CIS require additional prerequisites that you may need to plan for. Please consult with a CST advisor if you are considering choosing electives from CIS.

With the exception in footnote 4 above, the research and independent study courses shown below do not count as Integrative Genetics and Genomics electives, but they may count as free elective credits toward graduation. Most research courses can only be taken ONCE for a letter grade. Check individual course descriptions for details and/or exceptions.

Code	Title	Credit Hours
BIOL 2082	Independent Research I	1 to 4
BIOL 3082	Independent Research II	1 to 4
BIOL 3181	Cooperative Research in Biochemistry	3
BIOL 3681	Cooperative Studies	2 to 4
BIOL 3685	Externship Studies	3
BIOL 4291	Extrdepartmental Research	1 to 4
BIOL 4391	Accelerated Research in Biology	1 to 4
BIOL 4483	Accelerated Research in Biochemistry	3
BIOL 4491	Research in Biochemistry	3
BIOL 4591	Research in Neuroscience	1 to 4

Note: Grades of C- or higher are required unless otherwise specified in all courses for the major, including course prerequisites. The College of Science and Technology requires that students have a GPA of at least 2.00 overall and at least 2.00 in the courses applicable to their major and/or minor GPA to graduate.

A total of one semester of Biology research courses numbered lower than 4000 (to include: BIOL 2082, BIOL 3082, BIOL 3181, and BIOL 3681) may be taken for a letter grade. Any additional semesters in research courses in this category can be taken only on a CR/NC basis.

Suggested Academic Plan

Bachelor of Science in Integrative Genetics and Genomics

Suggested Plan for New Students Starting in the 2024-2025 Academic Year

Year 1		
Fall		Credit Hours
BIOL 1111 or BIOL 1911	Introduction to Organismal Biology or Honors Introduction to Organismal Biology	4
MATH 1041 or MATH 1941	Calculus I or Honors Calculus I	4
SCTC 1001	CST First Year Seminar	1
SCTC 1013	Elements of Data Science for the Physical and Life Sciences	3
GenEd Breadth Course		3
Credit Hours		15
Spring		
BIOL 1112 or BIOL 1912	Introduction to Biomolecules, Cells and Genomes or Honors Introduction to Biomolecules, Cells and Genomes	4
Select one of the following:		4
CHEM 1031 & CHEM 1033	General Chemistry I and General Chemistry Laboratory I	
CHEM 1951 & CHEM 1953	Honors General Chemical Science I and Honors Chemical Science Laboratory I	
Select one of the following:		4
MATH 1042 or MATH 1942	Calculus II or Honors Calculus II	
MATH 1044	Introduction to Probability and Statistics for the Life Sciences	
ENG 0802 or ENG 0812 or ENG 0902	Analytical Reading and Writing [GW] or Analytical Reading and Writing: ESL [GW] or Honors Analytical Reading and Writing [GW]	4
Credit Hours		16
Year 2		
Fall		Credit Hours
Select one of the following:		3-4
BIOL 3514	Biological Models in Python	
CIS 1051	Introduction to Problem Solving and Programming in Python	
CIS 1057	Computer Programming in C	
Select one of the following:		4
CHEM 1032 & CHEM 1034	General Chemistry II and General Chemistry Laboratory II	
CHEM 1952 & CHEM 1954	Honors General Chemical Science II and Honors Chemical Science Laboratory II	
Select one of the following:		4
PHYS 1021	Introduction to General Physics I	
PHYS 1061 or PHYS 1961	Elementary Classical Physics I or Honors Elementary Classical Physics I	
PHYS 2021 or PHYS 2921	General Physics I or Honors General Physics I	
IH 0851 or IH 0951	Intellectual Heritage I: The Good Life [GY] or Honors Intellectual Heritage I: The Good Life [GY]	3
Elective		1-0
Credit Hours		15
Spring		
BIOL 2207	Genetics	3
BIOL 2297	Research Techniques in Genetics [WI]	3

Select one of the following:		4
CHEM 2201 & CHEM 2203	Organic Chemistry I and Organic Chemistry Laboratory I	
CHEM 2921 & CHEM 2923	Organic Chemistry for Honors I and Organic Honors Laboratory I	
Select one of the following:		4
PHYS 1022	Introduction to General Physics II	
PHYS 1062 or PHYS 1962	Elementary Classical Physics II or Honors Elementary Classical Physics II	
PHYS 2022 or PHYS 2922	General Physics II or Honors General Physics II	
Elective		2
Credit Hours		16
Year 3		
Fall		
Select one of the following: ¹		3-4
BIOL 3204	Cell Structure and Function (F)	
Integrative Genetics and Genomics Elective ^{2, 3}		
Integrative Genetics and Genomics Elective ^{2, 3}		3-4
Select one of the following:		4
CHEM 2202 & CHEM 2204	Organic Chemistry II and Organic Chemistry Laboratory II	
CHEM 2922 & CHEM 2924	Organic Chemistry for Honors II and Organic Honors Laboratory II	
GenEd Breadth Course		3
Elective		2-0
Credit Hours		15
Spring		
Select one of the following: ¹		3-4
BIOL 3324	Molecular Biology	
BIOL 4375	General Biochemistry I	
Integrative Genetics and Genomics Elective ^{2, 3}		
BIOL 3113	Genome Analytics	3
Integrative Genetics and Genomics Elective ^{2, 3}		3-4
GenEd Breadth Course		3
Elective		3-1
Credit Hours		15
Year 4		
Fall		
BIOL 3403	Genomic Biology	3
BIOL 4XXX		4
GenEd Breadth Course		3
IH 0852 or IH 0952	Intellectual Heritage II: The Common Good [GZ] or Honors Intellectual Heritage II: The Common Good [GZ]	3
Elective		3
Credit Hours		16
Spring		
BIOL 4396	Advanced Study in Biology [WI]	3
Integrative Genetics and Genomics Elective ^{2, 3}		3-4
GenEd Breadth Course		3-4
Elective		3

Elective	3-1
Credit Hours	15
Total Credit Hours	123

Code	Title	Credit Hours
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(F) - Fall only course

(S) - Spring only course

¹ This program requires only one of the following courses: BIOL 3204, BIOL 3324 or BIOL 4375. Note that due to prerequisite requirements, BIOL 3324 and BIOL 4375 are shown in the next term of the suggested academic plan. If BIOL 3204 is completed it is not necessary to take BIOL 3324 or BIOL 4375 as the program only requires one of these three courses. If taken in addition to BIOL 3204 these courses can be used to fulfill one of the Integrative Genetics and Genomics electives required for this program.

² If the student has taken the necessary prerequisite courses, some of the Integrative Genetics and Genomics or Cognate elective courses may be taken before the Spring semester of Year 3.

³ Select an Integrative Genetics and Genomics elective.