BIOLOGY, BS

Banner Code: SC-BS-BIOL

Academic Advising

1200 Exploratory Hall
Fairfax Campus

Website: https://science.gmu.edu/academics/departments-units/biology/biology-bs

The Bachelor of Science in Biology provides a sound liberal arts education with substantial experience in quantitative and analytical thought, along with preparation for related professions. The program provides the strong background necessary for not only graduate study in the life sciences, but also enables students to develop careers in a wide variety of disciplines, including teaching, environmental management, microbiology, molecular biology, biotechnology, genetics, wildlife management, fisheries biology, and marine science. Furthermore, our curriculum prepares students for careers in the health sciences including medicine, dentistry, veterinary science, and related allied health disciplines.

Admissions & Policies

Admissions

University-wide admissions policies can be found in Undergraduate Admissions Policies (https://catalog.gmu.edu/admissions/undergraduate-policies/).

To apply for this program, please complete the George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now).

Policies

Students must fulfill all Requirements for Bachelor's Degrees (https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2), including the Mason Core (https://catalog.gmu.edu/mason-core/).

Important information and departmental policies are listed in the Department of Biology (https://catalog.gmu.edu/colleges-schools/science/biology/).

BIOL 400 News Views: Selected Topics (Mason Core) (https://catalog.gmu.edu/mason-core/) or MLAB 300 Science Writing (Mason Core) (https://catalog.gmu.edu/mason-core/) meet the writing intensive requirement for this major.

For policies governing all undergraduate degrees, see AP.5 Undergraduate Policies (https://catalog.gmu.edu/policies/academic/undergraduate-policies/).

Important Program Requirements

- Students may not apply more than 4 credits of lower-level BIOL prefixed courses (or equivalent transfer credit at the 100 to 200-level) toward the BS without Concentration electives if taken before the successful completion of BIOL 213 Cell Structure and Function and BIOL 215 Cell Structure and Function Laboratory.
- Biology majors must earn a minimum grade of 'C' in all Core Courses under the "Biology Core Courses" header. A grade of 'C' or better must be earned in BIOL 213 Cell Structure and Function and BIOL 215 Cell Structure and Function Laboratory in order to advance to other core requirements.
- Students may **not** count BIOL 124 Human Anatomy and Physiology I and/or BIOL 125 Human Anatomy and Physiology II toward any Biology, BS requirement.
- Students may count BIOL 303 Animal Biology and/or BIOL 304 Plant Biology as biology electives.
- At least 44 credits must be taken from the "Biology Core Courses" header and all listed "Biology Elective" coursework (with or without a concentration).
- BIOL 493 Honors Research in Biology, BIOL 495 Directed Studies in Biology, and BIOL 497 Special Problems in Biology do not satisfy the requirements of the BS degree which state that students must complete at least two upper division courses that include a laboratory. The courses do, however, count as non-laboratory electives.
  - The total limit for BIOL 493 Honors Research in Biology, BIOL 495 Directed Studies in Biology, and BIOL 497 Special Problems in Biology combined is 6 credits toward the 44 credits required for the BS.

Several optional concentrations are available; details on each can be found in the Requirements tab.

Teacher Licensure

Students who wish to become teachers can pursue either the Biology, BA (https://catalog.gmu.edu/colleges-schools/science/biology/biology-ba/) or the Biology, BS in addition to obtaining teaching credentials. For more information, visit the Secondary Education program's webpage (https://education.gmu.edu/secondary-education/).

Requirements

Degree Requirements

Total credits: minimum 120

Students should refer to the Admissions & Policies tab for specific policies related to this program.

Students must complete the program with a minimum GPA of 2.00.

All students must complete the *Biology Core Courses* and the *Supporting Core Courses* listed below. While a concentration is

not required (see the *BS without Concentration*), students may elect to declare a concentration (requirements listed below).

Biology Core Courses

Code	Title	Credits
BIOL 102	Introductory Biology I-Survey of Biodiversity and Ecology (Mason Core) (https://catalog.gmu.edu/mason-core/)	4
BIOL 103 & BIOL 105	Introductory Biology II-Survey of Cell and Molecular Biology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Introductory Biology II Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	4
BIOL 213 & BIOL 215	Cell Structure and Function and Cell Structure and Function Laboratory	4
BIOL 214	Biostatistics for Biology Majors	4
BIOL 308 & BIOL 338	Foundations of Ecology and Evolution and Foundations of Ecology and Evolution Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	4
or BIOL 300	BioDiversity	
BIOL 311 & BIOL 313	General Genetics and General Genetics Laboratory	4
BIOL 400	News Views: Selected Topics (Mason Core) (https://catalog.gmu.edu/mason-core/) [1]	3
Total Credits		**27**

[1] Fulfills writing intensive requirement.

Supporting Core Courses

Code	Title	Credits
Chemistry		
CHEM 211 & CHEM 213	General Chemistry I (Mason Core) (https://catalog.gmu.edu/mason-core/) and General Chemistry Laboratory I (Mason Core) (https://catalog.gmu.edu/mason-core/)	4
CHEM 212 & CHEM 214	General Chemistry II (Mason Core) (https://catalog.gmu.edu/mason-core/) and General Chemistry Laboratory II (Mason Core) (https://catalog.gmu.edu/mason-core/)	4
CHEM 313 & CHEM 315	Organic Chemistry I and Organic Chemistry Lab I	5
Physics		
Select one sequence from the following:		8
PHYS 160 & PHYS 161 & PHYS 260 & PHYS 261	University Physics I (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics I Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics II (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics II Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	
PHYS 243 & PHYS 244 & PHYS 245 & PHYS 246	College Physics I (Mason Core) (https://catalog.gmu.edu/mason-core/) and College Physics I Lab (Mason Core) (https://catalog.gmu.edu/mason-core/) and College Physics II (Mason Core) (https://catalog.gmu.edu/mason-core/) and College Physics II Lab (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Mathematics		
Select one from the following: [1]		4-6
MATH 111	Linear Mathematical Modeling (Mason Core) (https://catalog.gmu.edu/mason-core/)	
MATH 113	Analytic Geometry and Calculus I (Mason Core) (https://catalog.gmu.edu/mason-core/)	
MATH 123 & MATH 124	Calculus with Algebra/Trigonometry, Part A and Calculus with Algebra/Trigonometry, Part B (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Computer Science		**3**
CDS 130	Computing for Scientists (Mason Core) (https://catalog.gmu.edu/mason-core/) [2]	
Any course(s) that fulfill the Mason Core: Information Technology and Computing Requirement (https://catalog.gmu.edu/mason-core/#information-technology)		
Total Credits		**28-30**

[1] Students expecting to enter a health professions school or a graduate program are strongly encouraged to complete MATH 113 Analytic Geometry and Calculus I (Mason Core) (https://catalog.gmu.edu/mason-core/).

[2] Recommended by the Department of Biology.

BS without Concentration

This program provides a sound liberal arts education with substantial experience in quantitative and analytical thought. The BS without Concentration option provides students with the flexibility to explore and prepare for a career in a wide variety of

disciplines, including: teaching, health sciences, environmental management, microbiology, molecular biology, biotechnology, genetics, wildlife management, fisheries biology, and marine science.

Students pursuing the BS without Concentration option must complete the curriculum requirements listed below:

Code	Title	Credits
Biology Electives		
Select 17 credits from the following: [1]		17
Non-laboratory Courses		
BIOL 101	Biology Freshman Seminar	
BIOL 177	Introductory Ecology for Environmental Engineers	
BIOL 302	Alternative Careers in Biology	
BIOL 305	Biology of Microorganisms	
BIOL 309	Oceanography	
or EVPP 309	Oceanography	
or GEOL 309	Oceanography	
BIOL 312	Biostatistics for Bioinformatics	
BIOL 318	Conservation Biology	
BIOL 322	Developmental Biology	
BIOL 326	Animal Physiology	
BIOL 331	Invertebrate Zoology	
BIOL 334	Vertebrate Paleontology	
or GEOL 334	Vertebrate Paleontology (Mason Core) (https://catalog.gmu.edu/mason-core/)	
BIOL 336	Invertebrate Paleontology	
or GEOL 312	Invertebrate Paleontology	
BIOL 344	Plant Diversity and Evolution	
BIOL 345	Plant Ecology	
BIOL 350	Freshwater Ecosystems	
or EVPP 350	Freshwater Ecosystems	
BIOL 377	Applied Ecology	
or EVPP 377	Applied Ecology	
BIOL 382	Introduction to Virology	
BIOL 385	Biotechnology and Genetic Engineering	
BIOL 404	Medical Microbiology	
BIOL 408	Mushrooms, Molds and Society	
or EVPP 408	Mushrooms, Molds and Society	
BIOL 412	Phage Genomics	
BIOL 413	Histotechniques	
BIOL 417	Selected Topics in Molecular and Cellular Biology	
BIOL 420	Vaccines	
BIOL 421	Genetics of Human Diseases	
BIOL 423	Biology of Obesity and Weight Loss	
BIOL 425	Human Physiology	
BIOL 426	Mechanisms of Aging	
BIOL 427	Disease Ecology and Conservation	
or EVPP 427	Conservation Medicine	
BIOL 429	Biological Foundations of Pharmacology	
BIOL 432	Clinical Applications in Human Physiology	
BIOL 435	Selected Topics in Biology	
BIOL 443	Tropical Ecology	
BIOL 449	Marine Ecology	
BIOL 450	Marine Conservation	
BIOL 452	Immunology	
BIOL 454	Marine Mammal Biology and Conservation	
BIOL 457	Reproductive Strategies	
BIOL 460	Infectious Diseases Wildlife	
or EVPP 460	Infectious Diseases of Wildlife	
BIOL 472	Introductory Animal Behavior	
BIOL 482	Introduction to Molecular Genetics	
BIOL 483	General Biochemistry	
EVPP 419	Marine Mammal Biology and Conservation	
EVPP 421	Marine Conservation	
EVPP 449	Marine Ecology	
EVPP 451	Fungi and Ecosystems	
CONS 472	Introduction to Animal Behavior	
CONS 480	Primate Behavior, Ecology and Conservation	
Upper-level Laboratory Courses		
BIOL 303	Animal Biology	
BIOL 304	Plant Biology	
BIOL 305 & BIOL 306	Biology of Microorganisms and Biology of Microorganisms Laboratory [2]	
BIOL 322 & BIOL 323	Developmental Biology and Environmental Effects on Embryonic Development	
BIOL 377 & BIOL 378	Applied Ecology and Applied Ecology Laboratory	
BIOL 385 & BIOL 486	Biotechnology and Genetic Engineering and Molecular Biology and Biotechnology Laboratory	
BIOL 401	Phage Discovery	
BIOL 405	Microbial Genetics	
BIOL 407	Microbial Diversity	
BIOL 430	Advanced Human Anatomy and Physiology I	
BIOL 431	Advanced Human Anatomy and Physiology II	
BIOL 437	Ornithology	
or EVPP 437	Ornithology	
BIOL 438	Mammalogy	
or EVPP 438	Mammalogy	
BIOL 439	Herpetology	
or EVPP 439	Herpetology	
BIOL 440	Field Biology	
or CONS 440	Ecology Field Skills	

BIOL 443 & BIOL 444	Tropical Ecology and Tropical Ecology Laboratory	
BIOL 452 & BIOL 453	Immunology and Immunology Laboratory	
BIOL 465	Histology	
BIOL 472 & BIOL 473	Introductory Animal Behavior and Introductory Laboratory in Animal Behavior	
BIOL 485	Cell Signaling Laboratory	
EVPP 441	Protist Diversity and Ecology	
CONS 332	Insect Biology	
CONS 402	Applied Conservation	
CONS 404	Biodiversity Monitoring	
CONS 405	Landscape and Macrosystems Ecology	
CONS 406	Small Population Management	
Additional Science Courses		
Students are encouraged to consult with a biology faculty advisor to determine which option (A, B, or C) best meets their career goals. Select one from the following options		3-8
Option A:		
CHEM 314 & CHEM 318	Organic Chemistry II and Organic Chemistry Lab II	
Option B:		
One 3 credit chemistry course at the 300 or 400-level (not CHEM 314) (https://catalog.gmu.edu/courses/chem/)		
Option C:		
GEOL 101 & GEOL 103	Physical Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Physical Geology Lab (Mason Core) (https://catalog.gmu.edu/mason-core/) (Natural Science courses)	
GEOL 102 & GEOL 104	Historical Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Historical Geology Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Total Credits		**20-25**

[1] Of which, at least 13 credits must be upper division, and at least two of the upper division courses must include a laboratory.

[2] This lecture and lab combination can be taken together or separately.

Concentration in Bioinformatics (BNF)

The highly interdisciplinary field of bioinformatics has emerged as a powerful modern science. There is a great demand for undergraduate and graduate-level trained individuals with a background in bioinformatics in industry as well as in academia.

Code	Title	Credits
Biology Electives for the Bioinformatics Concentration		
Required Computer Science		
CDS 230	Modeling and Simulation I	3
Required Bioinformatics		
BINF 401	Bioinformatics and Computational Biology I	3
BINF 402	Bioinformatics and Computational Biology II	3
Required Biology		
BIOL 305 & BIOL 306	Biology of Microorganisms and Biology of Microorganisms Laboratory	4
BIOL 312	Biostatistics for Bioinformatics	3-4
or PSYC 300	Statistics in Psychology	
or STAT 354	Probability and Statistics for Engineers and Scientists II	
BIOL 401	Phage Discovery	3
BIOL 412	Phage Genomics	3
Additional Science Courses		
Select one from the following options: [1]		3-8
Option A:		
CHEM 314 & CHEM 318	Organic Chemistry II and Organic Chemistry Lab II	
Option B:		
One 3 credit chemistry course at the 300 or 400-level (not CHEM 314) (https://catalog.gmu.edu/courses/chem/)		
Option C:		
GEOL 101 & GEOL 103	Physical Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Physical Geology Lab (Mason Core) (https://catalog.gmu.edu/mason-core/)	
GEOL 102 & GEOL 104	Historical Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Historical Geology Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Total Credits		**25-31**

[1] Students are encouraged to consult with a biology advisor to determine which option (A, B, or C) best meets their career goals.

Concentration in Biopsychology (BP)

The biopsychology concentration consists of a selection of courses designed to address the needs and interest of students who wish to study biology in more depth while simultaneously exploring psychology and neurobiology. This concentration will help prepare students for the MCAT section related to psychology and provide veterinary students with a background in animal learning/behavior.

Code	Title	Credits
Biology Electives for the Biopsychology Concentration		
Biopsychology Required Courses		
BIOL 430	Advanced Human Anatomy and Physiology I	4
BIOL 431	Advanced Human Anatomy and Physiology II	4
PSYC 372	Biopsychology	3
PSYC 373	Biopsychology Laboratory	2
Additional Psychology/Neuroscience Course		
Select 3-4 credits from the following:		3-4
PSYC 304	Principles of Learning (Mason Core) (https://catalog.gmu.edu/mason-core/)	
PSYC 376	Brain and Behavior	
PSYC 406	Psychology of Communication (Mason Core) (https://catalog.gmu.edu/mason-core/)	
NEUR 327	Cellular Neuroscience	
NEUR 335	Developmental and Systems Neuroscience	
Additional Biology Courses		
Select 3-4 credits, not previously taken, from the Biology Electives listed under the BS without Concentration option (above).		3-4
Additional Chemistry Courses		
Select one from the following options: [1]		3-5
Option A:		
CHEM 314 & CHEM 318	Organic Chemistry II and Organic Chemistry Lab II	
Option B:		
One chemistry course at the 300 or 400-level (https://catalog.gmu.edu/courses/chem/) [2]		
Total Credits		**22-26**

[1] Students are encouraged to consult with a biology faculty advisor to determine which option best meets their career goals.

[2] CHEM 314 Organic Chemistry II alone does not fulfill this requirement.

Concentration in Biotechnology and Molecular Biology (BTMB)

The biotechnology and molecular biology concentration consists of a selection of courses that provide essential skills to students who seek employment in the field or wish to include an applied component in their undergraduate training in biology.

Code	Title	Credits
Biology Electives for the Biotechnology and Molecular Biology Concentration		
Biotechnology Required Courses		
BIOL 305 & BIOL 306	Biology of Microorganisms and Biology of Microorganisms Laboratory	4
BIOL 385	Biotechnology and Genetic Engineering	3
BIOL 483	General Biochemistry	4
Additional Biology Courses		
Select 5-8 credits from the following, at least one of the selections must be chosen from the Laboratory Courses section:		6-8
Laboratory Courses:		
BIOL 405	Microbial Genetics	
BIOL 452 & BIOL 453	Immunology and Immunology Laboratory	
BIOL 465	Histology	
BIOL 486	Molecular Biology and Biotechnology Laboratory	
Non-laboratory Courses:		
BIOL 382	Introduction to Virology	
BIOL 401	Phage Discovery	
BIOL 411	Advanced General Genetics	
BIOL 412	Phage Genomics	
BIOL 418	Current Topics in Microbiology [1]	
BIOL 420	Vaccines	
BIOL 421	Genetics of Human Diseases	
BIOL 422	Stem Cell Biology and Regenerative Medicine	
BIOL 482	Introduction to Molecular Genetics	
BIOL 484	Cell Signaling and Disease	
BIOL 497	Special Problems in Biology [1]	
Additional Chemistry Courses		
CHEM 314 & CHEM 318	Organic Chemistry II and Organic Chemistry Lab II	5
Total Credits		**22-24**

[1] Registration for BIOL 417 Selected Topics in Molecular and Cellular Biology, BIOL 418 Current Topics in Microbiology, or BIOL 497 Special Problems in Biology is subject to approval by the Director of Undergraduate Studies and the Chair of the Department of Biology.

Concentration in Environmental and Conservation Biology (ESCB)

This concentration is offered to students seeking a biology degree that focuses on ecology and organismal biology and prepares them for graduate work or employment in environmental and conservation fields, such as natural resources management, fisheries, forestry, water quality management, aquatic and wetland ecology, and conservation biology. The concentration is staffed and supported by the Department of Environmental Science and Policy (https://catalog.gmu.edu/colleges-schools/science/environmental-policy/).

Code	Title	Credits
Biology Electives for the Environmental and Conservation Biology Concentration		
Required Environmental and Conservation Biology		
BIOL 318	Conservation Biology	3

BIOL 377	Applied Ecology	3
Additional Biology [1]		
Non-laboratory Courses:		
Select 3-4 credits from the following:		3-4
BIOL 309	Oceanography	
or EVPP 309	Oceanography	
or GEOL 309	Oceanography	
BIOL 314	Introduction to Research Design and Analysis	
BIOL 326	Animal Physiology	
BIOL 351	Conservation Seminar	
BIOL 352	Monitoring and Assessment of Biodiversity	
BIOL 355	Ecological Engineering and Ecosystem Restoration	
BIOL 379	RS: Ecological Sustainability (Mason Core) (https://catalog.gmu.edu/mason-core/)	
BIOL 443	Tropical Ecology	
BIOL 446	Ecological and Evolutionary Physiology	
BIOL 449	Marine Ecology	
BIOL 450	Marine Conservation	
BIOL 454	Marine Mammal Biology and Conservation	
BIOL 457	Reproductive Strategies	
BIOL 459	Fungi and Ecosystems	
BIOL 468	Vertebrate Natural History	
BIOL 480	The Diversity of Fishes	
BIOL 497	Special Problems in Biology [3]	
Laboratory Courses:		
Select 8 credits from the following:		8
BIOL 331	Invertebrate Zoology	
BIOL 332	Insect Biology	
BIOL 344	Plant Diversity and Evolution	
BIOL 345	Plant Ecology	
BIOL 350	Freshwater Ecosystems	
BIOL 357	Ecology Field Skills	
BIOL 378	Applied Ecology Laboratory	
BIOL 437	Ornithology	
BIOL 438	Mammalogy	
BIOL 439	Herpetology	
BIOL 440	Field Biology	
BIOL 331	Invertebrate Zoology	
BIOL 472	Introductory Animal Behavior	
Additional Science Courses		
Select one from the following options: [1]		3-8
Option A: [2]		
CHEM 314 & CHEM 318	Organic Chemistry II and Organic Chemistry Lab II	
Option B:		
One chemistry course at the 300 or 400-level (https://catalog.gmu.edu/courses/chem/) [2]		
Option C:		
GEOL 101 & GEOL 103	Physical Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Physical Geology Lab (Mason Core) (https://catalog.gmu.edu/mason-core/)	
GEOL 102 & GEOL 104	Historical Geology (Mason Core) (https://catalog.gmu.edu/mason-core/) and Historical Geology Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	
Total Credits		**20-26**

1 Students are encouraged to consult with a biology faculty advisor to determine which option best meets their career goals.

2 CHEM 314 Organic Chemistry II alone does not fulfill this requirement.

3 Registration in BIOL 497 Special Problems in Biology is subject to approval by the Director of Undergraduate Studies and the Chair of the Department of Biology.

Concentration in Microbiology (MIB)

This concentration offers lecture and laboratory courses in microbiology to prepare students for employment or advanced study in microbial genetics, physiology, diversity, and related fields.

Code	Title	Credits
Biology Electives for the Microbiology Concentration		
Required Microbiology Courses		
BIOL 305 & BIOL 306	Biology of Microorganisms and Biology of Microorganisms Laboratory	4
BIOL 405	Microbial Genetics	4
BIOL 407	Microbial Diversity	4
Additional Biology Courses		
Select 5 credits from the following:		5
BIOL 314	Introduction to Research Design and Analysis	
BIOL 382	Introduction to Virology	
BIOL 385	Biotechnology and Genetic Engineering	
BIOL 401	Phage Discovery	
BIOL 404	Medical Microbiology	
BIOL 412	Phage Genomics	
BIOL 418	Current Topics in Microbiology	
BIOL 420	Vaccines	
BIOL 452	Immunology	
BIOL 453	Immunology Laboratory	
BIOL 459	Fungi and Ecosystems	
BIOL 483	General Biochemistry	
Additional Chemistry Courses		

CHEM 314 & CHEM 318	Organic Chemistry II and Organic Chemistry Lab II	5
Total Credits		**22**

Mason Core and Elective Credits

In order to meet a minimum of 120 credits, this degree requires additional credits (specific credit counts by concentration are shown below), which may be applied toward any remaining Mason Core (https://catalog.gmu.edu/mason-core/) requirements (outlined below), Requirements for Bachelor's Degrees (https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2), and electives. Students are strongly encouraged to consult with their advisors to ensure that they fulfill all requirements.

- Without concentration: 40-46 credits
- BNF concentration: 32-40 credits
- BP concentration: 39-44 credits
- BTMB concentration: 39-41 credits
- ESCB concentration: 37-43 credits
- MIB concentration: 37-38 credits

Mason Core

Some Mason Core (https://catalog.gmu.edu/mason-core/) requirements may already be fulfilled by the major requirements listed above. Students are strongly encouraged to consult their advisors to ensure they fulfill all remaining Mason Core (https://catalog.gmu.edu/mason-core/) requirements.

All Integration-level requirements must be completed at George Mason and cannot be satisfied through transfer credit. These courses are integral to the university's educational philosophy and ensure that all graduates demonstrate proficiency in writing, critical thinking, and integrative learning consistent with the university's standards. Rare exceptions to this policy may only be granted by the Provost's Office.

Students who have completed the following credentials are eligible for a waiver of the Foundation and Exploration (lower level) requirement categories with the exception of Written Communication, which must be met by transferring in or taking an approved coruse at George Mason University. The Integration category (upper level) is not waived under this policy. See Admissions (https://catalog.gmu.edu/admissions/undergraduate-policies/#transfertext) for more information.

- VCCS Uniform Certificate of General Studies
- VCCS or Richard Bland Associate of Science (A.S.), Associate of Arts (A.A.), Associate of Arts and Sciences (A.A.&S.), or Associate of Fine Arts (A.F.A.)

Code	Title	Credits
Foundation Requirements		
Written Communication (lower-level) (https://catalog.gmu.edu/mason-core/#written)		3
Oral Communication (https://catalog.gmu.edu/mason-core/#oral)		3
Quantitative Reasoning (https://catalog.gmu.edu/mason-core/#quantitative)		3
Information Technology and Computing (https://catalog.gmu.edu/mason-core/#information-technology)		3
Exploration Requirements		
Arts (https://catalog.gmu.edu/mason-core/#arts)		3
Global Contexts (https://catalog.gmu.edu/mason-core/#global-contexts)		3
Global History (https://catalog.gmu.edu/mason-core/#global-history)		3
Literature (https://catalog.gmu.edu/mason-core/#literature)		3
Natural Science (https://catalog.gmu.edu/mason-core/#natural-science)		7
Social and Behavioral Sciences (https://catalog.gmu.edu/mason-core/#social-behavioral-science)		3
Just Societies (optional) (https://catalog.gmu.edu/mason-core/#justsocieties) [1]		
Integration Requirements		
Written Communication (upper-level) (https://catalog.gmu.edu/mason-core/#written-upper)		3
Writing Intensive (https://catalog.gmu.edu/mason-core/#wi) [2]		3
Mason Apex (https://catalog.gmu.edu/mason-core/#apex) [3]		3
Total Credits		**40**

[1] In addition to covering content related to the designated category, Exploration level courses marked with a Just Societies "flag" are specifically designed to help students learn how to interact effectively with others from all walks of life, including those with backgrounds and beliefs that differ from their own. Students who wish to increase their knowledge and skills in this area may choose to enroll in a Just Societies-flagged course. Students interested in this approach to completing their Mason Core Exploration Requirements should work closely with their advisor to identify the appropriate Just Societies-flagged courses.

[2] Most programs include the writing-intensive course designated for the major as part of the major requirements; this course is therefore not counted towards the total required for Mason Core.

[3] Minimum 3 credits required.

Honors

Honors in the Major

Admissions

Minimum requirements for invitation:

- GPA in biology courses must be 3.33 or better
- GPA in supporting requirements (math and other science) must be 3.00 or better
- Grade of ‘B’ or better in BIOL 213 Cell Structure and Function and BIOL 215 Cell Structure and Function Laboratory.

Students should apply for admission to the Honors Program during their first or second year at the university. Contact the Department of Biology (https://catalog.gmu.edu/colleges-schools/science/biology/) for information on applying.

Retention Requirements

Students in honors biology must maintain a biology GPA of 3.33 or better and a supporting GPA of 3.00 or better from the time they have accumulated 30 hours and thereafter. Students who fall below this standard will be given a one semester probationary period in which to bring their GPA back up to the minimum standard.

Requirements to Graduate with Biology Honors

Students are required to take 6 to 8 credits in honors courses in BIOL including three semesters of BIOL 494 Honors Seminar in Biology or two semesters of BIOL 494 Honors Seminar in Biology and one semester of BIOL 493 Honors Research in Biology. BIOL 498 Research Seminar may count towards one of the semester requirements of BIOL 494 Honors Seminar in Biology. The GPA requirements are as follows:

- Minimum 3.33 GPA in honors biology courses
- Minimum 3.33 GPA in biology requirements
- Minimum 3.00 GPA in supporting requirements
- Minimum 3.00 GPA overall

Accelerated Master's

Biology, BS/Biology, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the combined bachelor's and accelerated master's degree pathway program (accelerated master's or BAM) and obtain a Biology, BS and a Biology, MS through the Biology, BS/Biology, Accelerated MS in an accelerated time-frame after satisfactory completion of a minimum of 138 credits.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) for policies related to this program.

Students in an accelerated master's degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate (https://catalog.gmu.edu/admissions/graduate-policies/)Admission Policies (https://catalog.gmu.edu/admissions/graduate-policies/) and accelerated master's degree (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7-1) policies.

Students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall undergraduate GPA of at least 3.00, and:

1. Students should seek out the Biology, MS Program Director (https://catalog.gmu.edu/colleges-schools/science/systems-biology/biology-ms/#text) who will aid in preparing the plan of study and the student for success in graduate studies,
2. Provide two letters of recommendation from academic or professional sources, and
3. Students are encouraged to have completed a selection of the courses listed below with a grade of B or better:

Undergraduate Courses

Code	Title	Credits
BIOL 213 & BIOL 215	Cell Structure and Function and Cell Structure and Function Laboratory	4
BIOL 214	Biostatistics for Biology Majors	4
BIOL 300	BioDiversity	4
or BIOL 311 & BIOL 313	General Genetics and General Genetics Laboratory	

Students who are accepted into the BAM Pathway will be allowed to register for graduate-level courses after the successful completion of a minimum of 75 undergraduate credits.

Accelerated Master's Admission Requirements

Undergraduate students already admitted to the BAM Pathway will be admitted to the intended master's program if they have met the following criteria that will be verified:

- Submission of BAM Transition Form by the deadline stated on the form.
- Sufficient minimum overall 3.00 cumulative GPA for conferred undergraduate degree (which does not include any earned reserve graduate credits), including a GPA of 3.00 in biology coursework.
- Completion of approved advanced standing courses and any reserve graduate courses that have met the minimum grade requirement (please refer to AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7)).
- Successful completion of required minimum of 120 credits needed for undergraduate degree conferral (after exclusion of any satisfactory reserve graduate credits earned).
- Successfully meeting George Mason's requirements for undergraduate degree conferral (graduation) and timely submission of the application for graduation.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced Standing Courses

Students must complete at least 3 credits from the following list of graduate-level courses, while in undergraduate status, up to a maximum of 12:

Code	Title	Credits
BIOL 502	Adaptation in Biosystems	3
BIOL 508	Selected Topics in Animal Biology (When the topic is "Mechanisms of Aging" or "Research and Development in Biotechnology Companies" or "Biology of Obesity and Weight Loss")	3
BIOL 580	Computer Applications for the Life Sciences	3
or BINF 630	Bioinformatics Methods	
BIOL 682	Advanced Eukaryotic Cell Biology	3
BIOL 689	Interdisciplinary Tools in the Biosciences	3
BIOL 690	Introduction to Graduate Studies in Biology	1
BIOL 691	Current Topics in Biology (When the topic is "Principles of Biomedical Literature Review")	3
BIOL 695	Seminar in Molecular, Microbial, and Cellular Biology	1

Reserve Graduate Credits

While in undergraduate student status, students may complete up to 6 credits of graduate-level coursework that will only count toward the graduate degree program. Reserve credits must be selected from the curated list of courses above.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degree (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) and AP.1.4.4 Graduate Course Enrollment by Undergraduates (https://catalog.gmu.edu/policies/academic/registration-attendance/#ap-1-4-4).

Bachelor's Degree (selected), Bioinformatics Management, Accelerated PSM

Overview

This bachelor's/accelerated master's degree program allows academically strong undergraduates with a commitment to advance their education to obtain both the Biology, BS (https://catalog.gmu.edu/colleges-schools/science/biology/biology-bs/), or the Chemistry, BS (https://catalog.gmu.edu/colleges-schools/science/chemistry-biochemistry/chemistry-bs/), or the Computational and Data Sciences, BS (https://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-data-sciences-bs/), or the Physics, BS (https://catalog.gmu.edu/colleges-schools/science/physics-astronomy/physics-bs/), or the Neuroscience, BS (https://catalog.gmu.edu/colleges-schools/science/neuroscience-program/neuroscience-bs/) and the Bioinformatics Management, PSM (https://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/) degrees within an accelerated timeframe. Upon completion of this 138 credit accelerated program, students will be exceptionally well prepared for entry into their careers or into a doctoral program in the field or in a related discipline.

Students are eligible to apply for this accelerated program once they have earned at least 60 undergraduate credits and can enroll in up to 18 credits of graduate coursework after successfully completing 75 undergraduate credits. This flexibility makes it possible for students to complete a bachelor's and a master's in five years.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7). For policies governing all graduate degrees, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/). For more information on undergraduates enrolling in graduate courses, see AP.1.4.4 Graduate Course Enrollment by Undergraduates (https://catalog.gmu.edu/policies/academic/registration-attendance/#text).

Application Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies (https://catalog.gmu.edu/admissions/graduate-policies/) section of this catalog.

Important application information and processes for this accelerated master's program can be found here (https://www2.gmu.edu/admissions-aid/how-apply/accelerated-masters).

Students in the Biology, BS (https://catalog.gmu.edu/colleges-schools/science/biology/biology-bs/); Chemistry, BS (https://catalog.gmu.edu/colleges-schools/science/chemistry-biochemistry/chemistry-bs/); Computational and Data Sciences, BS (https://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-data-sciences-bs/); Neuroscience, BS (https://catalog.gmu.edu/colleges-schools/science/neuroscience-program/neuroscience-bs/); or Physics, BS (https://catalog.gmu.edu/colleges-schools/science/physics-astronomy/physics-bs/) with an overall GPA of at least 3.00 in their last 60 credits are welcome to apply to the Bioinformatics Management, PSM (https://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/) accelerated master's program. Applicants to this accelerated master's should have previously taken courses in molecular biology, computer science, calculus, physical chemistry, and statistics. Students with deficiencies in one or more of these areas may be required to take additional courses from the undergraduate curriculum.

The GRE requirement is waived for students accepted into this accelerated program.

Students should seek out the graduate program's advisor who will aid in choosing the appropriate graduate courses and help prepare the student for graduate studies.

Accelerated Option Requirements

After the completion of 75 undergraduate credits, students may complete 3 to 12 credits of graduate coursework that can apply to both the undergraduate and graduate degrees.

In addition to applying to graduate from the undergraduate program, students in the accelerated program must submit a bachelor's/accelerated master's transition form (available from the Office of the University Registrar (https://registrar.gmu.edu/forms/)) to the College of Science's Office of Academic and Student Affairs (https://cos.gmu.edu/about/contact-us/) by the last day to add classes of their final undergraduate semester. Students should enroll for courses in the master's program in the fall or spring semester immediately following conferral of the bachelor's degree, but should contact an advisor if they would like to defer up to one semester.

Students must maintain an overall GPA of 3.00 or higher in all graduate coursework and should consult with their faculty advisor to coordinate their academic goals.

Reserve Graduate Credits

Accelerated master's students may also take up to 6 graduate credits as reserve graduate credits. These credits do not apply to the undergraduate degree, but will reduce the master's degree by up to 6 credits. With 12 graduate credits counted toward the undergraduate and graduate degrees plus the maximum 6 reserve graduate credits, the credits necessary for the graduate degree can be reduced by up to 18.

Graduate Course Suggestions

The following list of suggested courses is provided for general reference. To ensure an efficient route to graduation and post-graduation readiness, students are strongly encouraged to meet with an advisor before registering for graduate-level courses.

Code	Title	Credits
BINF 630	Bioinformatics Methods	3
BINF 631	Molecular Cell Biology for Bioinformatics	3
GBUS 623	Marketing Management	3
GBUS 643	Managerial Finance	3
GBUS 738	Introduction to Machine Learning for Business Applications	3

Bachelor's Degree (selected)/Quantum Science and Engineering, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the combined bachelor's and accelerated master's degree pathway program (BAM Pathway) and obtain a Bachelor of Science degree in any College of Science major and a Master of Science in Quantum Science and Engineering in an accelerated time-frame after satisfactory completion of a minimum of 138 credits.

This accelerated option is offered jointly by undergraduate Bachelor of Science programs in the College of Science and the Quantum Science and Engineering, MS program, which is jointly offered by the College of Science (https://catalog.gmu.edu/colleges-schools/science/) and the College of Engineering and Computing (https://catalog.gmu.edu/colleges-schools/engineering-computing/).

Students in an accelerated master’s degree program must fulfill all university
requirements for the master's degree. See AP.6.7 Bachelor's/Accelerated Master's Degree (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) for policies related to this program. For policies governing all graduate degrees, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies (https://catalog.gmu.edu/admissions/graduate-policies/) and accelerated master's degree policies (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

Students must major in a College of Science Bachelor of Science program and will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits.

Accelerated Master's Admission Requirements

Undergraduate students already admitted to the BAM Pathway will be admitted to the intended master’s program if they have met the following criteria that will be verified:

- Submission of BAM Transition Form by stated deadline.
- Sufficient minimum 3.0 cumulative GPA for conferred undergraduate degree (which does not include any earned reserve graduate credits).
- Completion of approved advanced standing courses and any reserve graduate courses; please refer to policy A.P. 6.7 (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).
- Successful completion of required minimum of 120 credits needed for undergraduate degree conferral (after exclusion any satisfactory reserve graduate credits earned).
- Successfully meeting George Mason’s requirements for undergraduate degree conferral (graduation) and timely submitting the application for graduation.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced Standing Courses

Students must complete at least 3 credits from the following list of graduate-level courses while in undergraduate status, up to a maximum of 12.

Students are encouraged to consult with both their undergraduate advisor and the Quantum Science and Engineering, MS advisor:

Code	Title	Credits
Select from the following options:		**3-12**
Up to one 500-600 level specialized course from the following:		
ASTR 601	Computer Simulation in Astronomy	
BINF 690	Numerical Methods for Bioinformatics	
CS 583	Analysis of Algorithms	
CS 630	Advanced Algorithms	
CS 635	Foundations of Parallel Computation	
CSI 690	Numerical Methods	
ECE 511	Computer Architecture	
ECE 547	Applied Cryptography	
ECE 633	Error Control Coding	
ECE 647	Post-Quantum Cryptography	
GGS 579	Remote Sensing	
MATH 625	Numerical Linear Algebra	
MATH 685	Numerical Analysis	
MATH 686	Numerical Solutions of Differential Equations	
OR 541	Operations Research: Deterministic Optimization	
OR 542	Operations Research: Stochastic Models	
OR 646	Stochastic Optimization	
PHYS 510	Computational Physics I	
PHYS 613	Computational Physics II	
Remaining credits are selected from the following:		
QSE 500	Ideas in Quantum Science and Technology	
QSE 501	Mathematical Foundations of QSE [1]	
QSE 502	Programming Foundations of QSE [1]	
QSE 505	Classical and Quantum Information Theory	
QSE 511	Quantum Algorithms	
QSE 520	Applications of Quantum Technology	
QSE 570	Quantum Computing System Design	
or ECE 570	Quantum Computing System Design	

Reserve Credit Courses

Students may complete up to 6 credits while in undergraduate student status, of graduate-level coursework from the list below that will only count toward the graduate degree program.

Code	Title	Credits
Select up to 6 credits of not previously completed courses from the following:		**6**
QSE 500	Ideas in Quantum Science and Technology	
QSE 501	Mathematical Foundations of QSE [1]	
QSE 502	Programming Foundations of QSE [1]	
QSE 505	Classical and Quantum Information Theory	
QSE 511	Quantum Algorithms	
QSE 520	Applications of Quantum Technology	
QSE 570	Quantum Computing System Design	
or ECE 570	Quantum Computing System Design	

[1] As only one of these courses count for Quantum Science and Engineering, MS, credit, and these courses may not be necessary for all students, consult with an academic advisor prior to enrolling in QSE 501 Mathematical Foundations of QSE or QSE 502 Programming Foundations of QSE.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degree (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) and AP.1.4.4 Graduate Course Enrollment by Undergraduates (https://catalog.gmu.edu/policies/academic/registration-attendance/#ap-1-4-4).