

NEUROSCIENCE, BS

Banner Code: SC-BS-NEUR

Academic Advising

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The Bachelor of Science in Neuroscience is an interdisciplinary program emphasizing the relationship between the biology and chemistry of the nervous system and the behavior of an organism. The BS prepares students for graduate level study in both medical school and doctoral and master's level programs in neuroscience and other health-related fields, and work in the neuroscience field.

Admissions & Policies

Admissions

University-wide admissions policies can be found in the Undergraduate Admissions Policies (<https://catalog.gmu.edu/admissions/undergraduate-policies/>) section of this catalog.

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/>).

NEUR 411 Seminar in Neuroscience (Mason Core) (<https://catalog.gmu.edu/mason-core/>) fulfills the writing intensive requirement.

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

Requirements

Degree Requirements

Total credits: minimum 120

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

Foundation Courses

Code	Title	Credits
Biology		
BIOL 213	Cell Structure and Function ¹	4

Select one from the following: ^{1,2} 3-4

BIOL 311	General Genetics
BIOL 322	Developmental Biology
BIOL 326	Animal Physiology
BIOL 425	Human Physiology
BIOL 430	Advanced Human Anatomy and Physiology I

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

Mathematics

Select one option (4 or 6 credits) from the following: 4-6

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/)

Statistics

Select one course (3 or 4 credits) from the following: 3-4

BIOL 214	Biostatistics for Biology Majors
STAT 250	Introductory Statistics I (Mason Core) (https://catalog.gmu.edu/mason-core/)
PSYC 300	Statistics in Psychology
MATH 352	Statistics

Physics

Select one of the following sequences: 8

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/)
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/)

Psychology^{1,3}

PSYC 100	Introduction to Psychology (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
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PSYC 375	Brain and Sensory Processes	3
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PSYC 376	Brain and Behavior	3
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Computer Science

CDS 130	Computing for Scientists (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
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Core Courses in Neuroscience¹

NEUR 327 & NEUR 328	Cellular Neuroscience and Cellular Neuroscience Lab	5
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NEUR 335	Developmental and Systems Neuroscience	3
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Technical Writing^{1,2,4}

NEUR 411	Seminar in Neuroscience (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
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Required Psychology Lab Course¹

PSYC 373	Biopsychology Laboratory	2
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Total Credits		55-59
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¹ Students must earn a minimum grade of 1.67 (C-) in these courses.

² The course chosen to fulfill this requirement cannot be applied as a Major Elective.

³ Transfer students who have earned transfer credit for PSYC 372 Biopsychology may substitute this course for PSYC 375 Brain and Sensory Processes.

⁴ This course fulfills the writing intensive requirement.

Major Electives

Students should consult with an advisor to choose elective courses. The list below includes pre-approved courses. Elective courses not on the list must be approved by an advisor. Only courses not already taken in the degree will apply as electives, with the exception of seminar and topics courses; a different topic must be addressed in the second instance of a seminar or topics course. Students may apply no more than 6 credits of courses with a grade of 'D' to this requirement.

Students intending to pursue a doctorate in neuroscience or a medical degree are advised to take CHEM 313 Organic Chemistry I and CHEM 315 Organic Chemistry Lab I, and consult an advisor for other elective recommendations.

Code	Title	Credits
Select 22 credits of major electives. The list below includes pre-approved courses. Elective courses not on the list must be approved by an advisor.		22

BENG 101	Introduction to Bioengineering	
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BENG 434	Computational Modelling of Neurons and Networks	
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BIOL 305	Biology of Microorganisms	
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BIOL 306	Biology of Microorganisms Laboratory	
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BIOL 311	General Genetics	
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BIOL 322	Developmental Biology	
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BIOL 323	Environmental Effects on Embryonic Development	
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BIOL 326	Animal Physiology	
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BIOL 417	Selected Topics in Molecular and Cellular Biology (when the topic is: Foundations of the Mammalian Brain)	
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BIOL 420	Vaccines	
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BIOL 425	Human Physiology	
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BIOL 426	Mechanisms of Aging	
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BIOL 429	Biological Foundations of Pharmacology	
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BIOL 430	Advanced Human Anatomy and Physiology I	
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BIOL 431	Advanced Human Anatomy and Physiology II	
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BIOL 432	Clinical Applications in Human Physiology	
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BIOL 452	Immunology	
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BIOL 453	Immunology Laboratory	
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BIOL 471	Evolution	
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BIOL 482	Introduction to Molecular Genetics	
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BIOL 483	General Biochemistry	
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BIOL 484	Cell Signaling and Disease	
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BIOL 515	Developmental Neurobiology	
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CDS 301	Scientific Information and Data Visualization	
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CHEM 313	Organic Chemistry I	
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CHEM 314	Organic Chemistry II	
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CHEM 315	Organic Chemistry Lab I	
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CHEM 318	Organic Chemistry Lab II	
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CHEM 321	Quantitative Chemical Analysis	
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CHEM 463	General Biochemistry I	
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CHEM 464	General Biochemistry II	
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CHEM 465	Biochemistry Lab (Mason Core) (https://catalog.gmu.edu/mason-core/)	
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MATH 114 or MATH 116	Analytic Geometry and Calculus II Analytic Geometry and Calculus II (Honors)	
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MATH 203	Linear Algebra	
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MATH 213	Analytic Geometry and Calculus III	
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NEUR 355	Cross-Cultural Studies in Scientific Inquiry (Mason Core) (https://catalog.gmu.edu/mason-core/)	
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MATH 214	Elementary Differential Equations	
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NEUR 405	RS: Laboratory Methods in Behavioral Neuroscience	
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NEUR 406	Zebrafish Neurodevelopment Laboratory	
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NEUR 407	Lab Investigations Using Voltage Clamp Electrophysiology	
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NEUR 410	Current Topics in Neuroscience (when not used to fulfill the technical writing requirement) ¹	
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NEUR 411	Seminar in Neuroscience (Mason Core) (https://catalog.gmu.edu/mason-core/) ¹	
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NEUR 422	Glutamatergic Systems	
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NEUR 424	Sleep and Circadian Rhythms (Mason Core) (https://catalog.gmu.edu/mason-core/)	
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NEUR 440	Independent Study in Neuroscience	
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NEUR 450	Honors Thesis Proposal	
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NEUR 451	Honors Thesis	
NEUR 461	Special Topics in Neuroscience	
NEUR 473	Current Neuroscience Research in Germany (Mason Core) (https://catalog.gmu.edu/mason-core/)	
NEUR 480	Biological Bases of Alzheimer's Disease	
PHYS 262	University Physics III (Mason Core) (https://catalog.gmu.edu/mason-core/)	
PHYS 263	University Physics III Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/)	
PSYC 304	Principles of Learning (Mason Core) (https://catalog.gmu.edu/mason-core/)	
PSYC 309	Sensation, Perception, and Information Processing (Mason Core) (https://catalog.gmu.edu/mason-core/)	
PSYC 317	Cognitive Psychology	
PSYC 441	Criminal Behavior: Psychological and Neurological Aspects	
PSYC 472	Current Topics in Brain and Behavior	
Total Credits		22

¹ This course fulfills the writing intensive requirement.

Mason Core and Elective Credits

In order to meet a minimum of 120 credits, this degree requires an additional 39-43 credits 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 elective courses. Students are strongly encouraged to consult with their advisors to ensure that they fulfill all requirements.

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.

Students who have completed the following credentials are eligible for a waiver of the Foundation and Exploration (lower level) requirement categories. 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
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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)	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

Highly-qualified students may apply to graduate with honors in the major.

Eligibility

To be eligible for admission, neuroscience majors must have completed at least 60 credits and have a minimum cumulative GPA of 3.25 and a minimum GPA of 3.25 in neuroscience courses.

Honors Requirements

If accepted, students must take a sequence of three courses, which culminates in the successful completion and presentation of an independent honors thesis.

Code	Title	Credits
NEUR 410	Current Topics in Neuroscience	3
or NEUR 411	Seminar in Neuroscience (Mason Core) (https://catalog.gmu.edu/mason-core/)	

NEUR 450	Honors Thesis Proposal	2-3
NEUR 451	Honors Thesis	3-4
Total Credits		8-10

To graduate with honors, students must earn a minimum GPA of 3.50 in their honors courses, maintain a minimum cumulative GPA of 3.25, and complete an honors thesis.

Accelerated Master's

Neuroscience, BS/Biology, Accelerated MS

Overview

This bachelor's/accelerated master's degree program allows academically strong undergraduates with a commitment to advance their education to obtain both the Neuroscience, BS and the Biology, MS (<https://catalog.gmu.edu/colleges-schools/science/systems-biology/biology-ms/>) 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 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.

GRE scores are not required for students in this accelerated program.

Students must obtain a graduate faculty advisor prior to beginning graduate coursework.

Successful applicants will have an overall undergraduate GPA of at least 3.10. Two letters of recommendation, including one from a prospective thesis or project advisor, are required. Additionally, they will have completed² the following courses with a GPA of 3.00¹ or higher:

Code	Title	Credits
BIOL 213	Cell Structure and Function	4
One Course in Statistics:		3-4
BIOL 214	Biostatistics for Biology Majors	
or STAT 250	Introductory Statistics I (Mason Core) (https://catalog.gmu.edu/mason-core/)	
or PSYC 300	Statistics in Psychology	
or MATH 352	Statistics	
BIOL 311	General Genetics	4
CHEM 313	Organic Chemistry I	5
& CHEM 315	and Organic Chemistry Lab I ¹	
NEUR 327	Cellular Neuroscience ²	3

¹ Grades of 2.50 in CHEM 313 Organic Chemistry I and CHEM 315 Organic Chemistry Lab I are acceptable for admission into this accelerated pathway.

² Registration in, as opposed to completion of, NEUR 327 Cellular Neuroscience is sufficient.

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 Credit

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
BIOL 682	Advanced Eukaryotic Cell Biology	3
BIOL 689	Interdisciplinary Tools in the Biosciences	3
BIOL 690	Introduction to Graduate Studies in Biology	1-2

BIOL 695	Seminar in Molecular, Microbial, and Cellular Biology	1
NEUR 612	Bioscience, Neurotechnology Society	3
NEUR 601	Developmental Neuroscience	3
NEUR 602	Cellular Neuroscience	3
NEUR 603	Mammalian Neuroanatomy	3
NEUR 634	Neural Modeling	3
NEUR 651	Molecular Neuropharmacology	3

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	Data Mining for Business Analytics	3