

BIOSCIENCES (BIOS)

700 Level Courses

BIOS 701: *Systems Biology*. 3 credits.

Introduces biochemical systems to investigate complex, multicomponent, dynamic functions of cellular systems. Readings include articles from current literature in molecular biosciences. Application of molecular techniques within biosciences is now universal, and the underlying question remains "What is the structure of a cell, and how does it function?" Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit. Equivalent to BINF 701.

Recommended Prerequisite: General Biochemistry.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 702: *Research Methods*. 3 credits.

Trains students in research methodologies, techniques, and data analysis in life sciences. Divided into three modules that introduce separate but equally significant components of any research project: parameters required to outline and synthesize a problem, techniques of measurement and analysis used by life scientists, and approaches for data analysis and interpretations. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

Recommended Prerequisite: Admission to the PhD program in Biosciences

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 703: *Laboratory Rotation*. 3 credits.

Intensive introduction to research laboratory in biosciences. Students read background material pertinent to problem under study, learn and practice research methods of laboratory, and formulate short final project that may be proposal or actual project, demonstrating some mastery of techniques and approaches employed. Notes: Should be repeated three times (except by permission of concentration director). Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May be repeated within the term for a maximum 6 credits.

Specialized Designation: Topic Varies

Recommended Prerequisite: Admission to the PhD program in Biosciences.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Laboratory

Grading:

This course is graded on the Graduate Special scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 704: *Topics in Biosciences*. 1 credit.

Combines invited seminars from internal and external faculty with graduate student seminars. Seminar presentation required for advancement to candidacy, generally given in last semester before candidacy. Includes discussion section led by course coordinator. Notes: Required of all students during each semester prior to advancement to candidacy. Should be repeated three times (except by permission of concentration director). Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May be repeated within the term for a maximum 3 credits.

Specialized Designation: Topic Varies

Recommended Prerequisite: Admission to the PhD program in Biosciences.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lec/Sem #1, Lec/Sem #2, Lec/Sem #3, Lec/Sem #4, Lec/Sem #5, Lec/Sem #6, Lec/Sem #7, Lec/Sem #8, Lec/Sem #9, Sem/Lec #10, Sem/Lec #11, Sem/Lec #12, Sem/Lec #13, Sem/Lec #14, Sem/Lec #15, Sem/Lec #16, Sem/Lec #17, Sem/Lec #18, Seminar

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 710: *Current Topics in Bioscience*. 1-3 credits.

Studies current topic in biosciences. Notes: Topics vary. May be repeated for credit with permission of concentration director. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May be repeated within the term for a maximum 6 credits.

Specialized Designation: Topic Varies

Recommended Prerequisite: Admission to the PhD program in biosciences or to the MS program in biology.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lec/Sem #1, Lec/Sem #2, Lec/Sem #3, Lec/Sem #4, Lec/Sem #5, Lec/Sem #6, Lec/Sem #7, Lec/Sem #8, Lec/Sem #9, Lecture,

Sem/Lec #10, Sem/Lec #11, Sem/Lec #12, Sem/Lec #13, Sem/Lec #14, Sem/Lec #15, Sem/Lec #16, Sem/Lec #17, Sem/Lec #18

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 715: *Molecular Ecology*. 3 credits.

Introduces students to basic concepts of molecular biology, genetics, molecular evolution, bioinformatics, NextGen Sequencing and Technology. Students should have prior background in genetics and evolution. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit. Equivalent to EVPP 515.

Recommended Prerequisite: Undergraduate course in Genetics and Chemistry or permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 716: *Methods in Evolutionary Biology*. 4 credits.

Intended for students who plan to do research in Molecular Ecology, Molecular Evolution, Conservation Genetics, Genomics or Biocomplexity. The lecture reviews basic concepts while the lab provides students the opportunity to experience the detailed protocols necessary for research in molecular biology. The course integrates theory, protocols, analysis and bioinformatics. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

Recommended Prerequisite: BIOS 715 or permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Laboratory, Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 740: *Laboratory Methods in Functional Genomics and Biotechnology*. 3 credits.

Current laboratory techniques in molecular biology and genomics, including nucleic acid isolation, gene cloning and sequencing, gel blot analysis, PCR, in vitro mutagenesis, and theory and practice of DNA microarray analysis of gene expression. Topics may vary from year to year depending on advances in field. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

Recommended Prerequisite: Graduate standing and undergraduate courses in genetics and molecular biology.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 741: *Genomics*. 3 credits.

Genetic structure and function at whole genome level. Includes some sequence analysis, comparative genomics, classical genetics, and developmental genetics, as well as analysis of syntenic groups, isochores, gene families, genetic complexity, C value paradox, directed discovery of gene functions, and animal models of human disease. Readings from recent texts and primary research literature. Students expected to give one or two oral presentations of primary research papers, as well as complete midterm and final exams. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

Recommended Prerequisite: At least one undergraduate course in genetics and molecular biology, or permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 742: *Biotechnology*. 3 credits.

Theory and applications of biotechnology. Includes promoter design, gene fusions, protein targeting, techniques of protein purification, construction of transgenic organisms, cloning of animals and plants, ethical and legal issues. This is a relatively new area of study that is rapidly changing; course strives to keep students abreast of current literature. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

Recommended Prerequisite: Undergraduate coursework in genetics and molecular biology.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 743: *Genomics, Proteomics, and Bioinformatics*. 3 credits.

Fundamental methods for analyzing genomic and proteomic data, including nucleic acid and protein sequences, pair-wise and multiple alignment, database search methods, clustering and presentation of data, prediction modeling, and survey of available software and freeware tools.

Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

Recommended Prerequisite: Admission to PhD program in biosciences or to MS program in biology.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 744: *Molecular Genetics*. 3 credits.

Develops understanding of principles of modern molecular genetics and methods of investigation of genomes of pro- and eukaryotes, including types of genetic manipulations conducted in research laboratories today. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

Recommended Prerequisite: Undergraduate coursework including BIOL 311; CHEM 313, 314, 315, and 318; equivalents; or permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 761: *Dispersal Patterns of Biological Agents*. 3 credits.

Introduces military and terrorist methods of dispersal patterns. Covers physics of aerosols, engineering and mechanics of building ventilation systems, and mechanical dissemination including handheld, automatic, vehicle, and truck-mounted systems. Also covers viability of specific agents involved. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

Recommended Prerequisite: Admission to PhD Biosciences program or MS/Biology program, and permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 767: *Molecular Evolution*. 3 credits.

A review of the diversity and organization of genomes and evolutionary processes that operate at the molecular level. Emphasis will be placed on processes of molecular evolution and techniques used to analyze these processes. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May not be repeated for credit.

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Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

800 Level Courses

BIOS 898: *Directed Studies in Biosciences*. 1-12 credits.

Studies of specialized topics in biosciences. Specific arrangements for designing scope and area of study to be determined in consultation with instructor. May involve literature searches and review, workshops, or tutorials. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May be repeated within the degree for a maximum 24 credits.

Recommended Prerequisite: Permission of Research Advisor.

Registration Restrictions:

Enrollment is limited to Graduate level students.

Schedule Type: Research

Grading:

This course is graded on the Graduate Special scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 899: *Directed Research in Biosciences*. 1-12 credits.

Research on a pertinent topic in biosciences. Scope and subject of research to be determined by instructor. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May be repeated within the degree for a maximum 24 credits.

Recommended Prerequisite: Permission of Research Advisor.

Registration Restrictions:

Enrollment is limited to Graduate level students.

Schedule Type: Research

Grading:

This course is graded on the Graduate Special scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

900 Level Courses

BIOS 998: *Doctoral Dissertation Proposal*. 1-6 credits.

Research and writing of research proposal for doctoral dissertation. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May be repeated within the degree.

Recommended Prerequisite: Permission of research advisor.

Registration Restrictions:

Enrollment is limited to Graduate level students.

Schedule Type: Dissertation

Grading:

This course is graded on the Satisfactory/No Credit scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

BIOS 999: *Doctoral Dissertation Research*. 1-12 credits.

Research in concentration pertinent to students' program of study. Notes: Maximum of 24 credits can be applied toward degree. Offered by School of Systems Biology (<http://catalog.gmu.edu/colleges-schools/science/systems-biology/>). May be repeated within the degree.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy.

Enrollment is limited to Graduate level students.

Schedule Type: Dissertation

Grading:

This course is graded on the Satisfactory/No Credit scale. (<http://catalog.gmu.edu/policies/academic/grading/>)