Bachelor of Science in Molecular Life Sciences
Molecular Life Sciences Program
College of Arts + Sciences

Academic Advising
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IMPORTANT

This document is intended to be a temporary—and *unofficial*—guide for students interested in pursuing this degree program, which will become available May 2018. Students may only declare this degree program once the *2018-2019 College of Arts and Sciences Bulletin* is published and will be held to the requirements as listed therein.

Purpose

The B.S. in Molecular Life Sciences (MLS) is designed for students interested in pursuing a life sciences degree curriculum that is highly focused on cellular and molecular mechanisms. Advanced courses will provide an emphasis on how alterations in cellular processes may lead to disease states. It is ideal for students planning to continue their education beyond a bachelor's degree either in the pursuit of an advanced M.S. or Ph.D. degree in the life sciences or professional degrees in medicine, veterinary sciences or dentistry. Students with a B.S. in MLS will have also have the background necessary to pursue careers in the biotechnology and pharmaceutical industries.

CASE requirements

In addition to the CASE Credit Hour and Residency Requirements, students must complete the following:

1. CASE Foundations
    a. English Composition
    b. Mathematical Modeling
2. CASE Breadth of Inquiry
    a. Arts and Humanities: two (2) courses
    b. Social and Historical Studies: two (2) courses
    c. Natural and Mathematical Sciences: four (4) courses (typically fulfilled by the major)
3. CASE Culture Studies
    - Not required for this degree program
4. CASE Foreign Language
    - Proficiency in a single foreign language at or above the first semester of the second year of college-level course work.
5. CASE Critical Approaches
6. CASE Public Oral Communication
7. CASE Intensive Writing

Major requirements

Students must complete at least 50 credit hours in the major[1], including the following:

1. **Chemistry Requirements.** Each of the following:
    - CHEM-C 117 Principles of Chemistry and Biochemistry I
    - CHEM-C 127 Principles of Chemistry and Biochemistry I Laboratory
    - CHEM-C 341 Organic Chemistry I Lectures
    - CHEM-C 342 Organic Chemistry II Lectures
    - CHEM-C 343 Organic Chemistry I Laboratory
    - Biological Chemistry. One (1) of the following:

- CHEM-C 383 Human Biochemistry
- CHEM-C 483 Biological Chemistry

2. **Biology Requirements.** Each of the following courses:
   - BIOL-L 112 Foundations of Biology: Biological Mechanisms
   - BIOL-L 211 Molecular Biology
   - BIOL-L 312 Cell Biology
3. **Lab Requirement.** One (1) of the following:
   - BIOL-L 323 Molecular Biology lab
   - BIOT-T 315 Molecular Biology Lab
4. **MLS Core.** Each of the following:
   - MLS-M 420 Genome Duplication and Maintenance
   - MLS-M 430 Advanced Gene Regulation
5. **Concentration.** At least one (1) of the following concentrations (a or b):
   a. **Molecular and Structural Biology Concentration.** Each of the following (i–iv):
      i. Protein Lab.
         - BIOT-T 425 Lab in Macromolecular Production, Purification, & Characterization
      ii. Bioinformatics.
         - BIOL-L 388 Digital Biology: A Survey of Topics in Bioinformatics and Genomics
      iii. Protein Metabolism.
         - MLS-M 410 Protein Metabolism
      iv. Electives. At least one (1) of the following:
         - MLS-M 440 Membranes and Signal Transduction
         - MLS-M 450 Molecular Mechanisms of Cancer

   b. **Developmental and Cellular Biology Concentration.** Each of the following (i–iv):
      i. Genetics.
         - BIOL-L 311 Genetics
      ii. Developmental Biology.
         - BIOL-L 417 Developmental Biology
      iii. Lab Course. One (1) of the following:
         - BIOL-L 313 Cell Biology Lab
         - BIOL-L 319 Genetics Laboratory
         - BIOL-Z 318 Developmental Biology Laboratory
      iv. Electives. At least two (2) of the following:
         - MLS-M 450 Molecular Mechanisms of Cancer
         - BIOL-L 388 Digital Biology: A Survey of Topics in Bioinformatics and Genomics
         - PSY-P 410 Development of Brain and Behavior
         - PSY-P 457 Topics in Psychology ("Development and Maintenance of Brain Circuits" topic only)
         - PSY-P 466 Molecular and Cellular Neuroscience
         - PSY-P 470 Molecular Methods in Neuroscience
6. **Addenda Requirements**[2]**.**
   a. **Mathematics.** One (1) of the following:
      - MATH-M 211 Calculus 1
      - MATH-M 212 Calculus 2
      - MATH-M 120 Brief Survey of Calculus 2

   b. **Statistics.** One (1) of the following:
      - ANTH-A 306 Anthropological Statistics
      - ECON-E 370 Statistical Analysis for Business and Economics
      - ECON-S 370 Statistical Analysis for Business and Economics: Honors
      - MATH-K 310 Statistical Techniques
      - POLS-Y 395 Quantitative Political Analysis
      - PSY-K 300 Statistical Techniques
      - PSY-K 310 Statistical Techniques
      - SOC-S 371 Statistics in Sociology

- STAT-K 310 Statistical Techniques
- STAT-S 300 Introduction to Applied Statistical Methods
- STAT-S 301 Applied Statistical Methods for Business
- STAT-S 303 Applied Statistical Methods for the Life Sciences

c. **Physics Requirement.** Both of the following (i and ii):
   i. **Physics I.** One (1) of the following:
      - PHYS-P 201 General Physics I
      - PHYS-P 221 Physics I
   ii. **Physics II.** One (1) of the following:
      - PHYS-P 202 General Physics II
      - PHYS-P 222 Physics II

[1] Including the addenda requirements (requirement 6 of the major), it will take a typical student 67–70 credit hours to complete all requirements for the major.
[2] Courses used to fulfill addenda requirements require a grade of C– or higher and do not count toward the Major GPA or Major Hours.

New Courses

- **MLS-M 410 Protein Metabolism (3 cr.)** P: BIOL-L 211 or equivalent. Focuses on the mechanisms and enzymes that synthesize, fold, traffic and degrade proteins. Provides a molecular and structural view of key processes such as translation, folding, membrane insertion, vesicular trafficking, post-translational modification and protein degradation. Emphasizes broader principles such as NTP switches as regulators and macromolecular interaction events; explains how cellular architecture underpins function. Describes structural and mechanistic features of protein metabolism in a cellular context.
- **MLS-M 420 Genome Duplication and Maintenance (3 cr.)** P: BIOL-L 211 or equivalent. Examines genomic structure, DNA topology and replication mechanisms in the context of cell function for all three domains of life. Studies the pathological consequences of failure to duplicate and maintain the genome.
- **MLS-M 430 Advanced Gene Regulation (3 cr.)** P: BIOL-L 211 or equivalent. Considers mechanistic, structural and regulatory aspects of the process by which information coded in DNA is transcribed into messenger and structural RNAs. Investigates the role of post-translational modification on nucleosome tails and on the RNA polymerase itself to regulate the timing and extent of transcription. Examines how regulatory marks are written and interpreted.
- **MLS-M 440 Membranes and Signal Transduction (3 cr.)** P: BIOL-L 211 or equivalent. Provides a detailed introduction to membrane physiology from a structural and mechanistic perspective. Considers membranes and membrane-embedded proteins that serve as barriers and gatekeepers to regulate material flow in and out of cells and organelles, act as a capacitor to support chemical energy synthesis, and support signal transduction to respond to environmental cues.
- **MLS-M 450 Molecular Mechanisms of Cancer (3 cr.)** P: BIOL-L 211 or equivalent. Focuses on the molecular basis of genome instability, including factors that lead to tumorigenesis and tumor suppression. Studies the action mechanisms and disease relevance of key enzymes, along with available and emerging treatments for cancer.

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