Fiscal Unit/Academic Org	Introductory Biology - D0326
Administering College/Academic Group	Arts and Sciences
Co-adminstering College/Academic Group	
Semester Conversion Designation	New Program/Plan
Proposed Program/Plan Name	Biotech Science
Type of Program/Plan	Undergraduate minor
Program/Plan Code Abbreviation	BIOTECH
Proposed Degree Title	Minor in Biotech Science

Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program				15	
Required credit hours offered by the unit	Minimum			11	
	Maximum			13	
Required credit hours offered outside of the unit	Minimum			27	
	Maximum			51	
Required prerequisite credit hours not included above	Minimum			0	
	Maximum			0	

Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

Program Learning Goals

- 1. Demonstrate a strong foundational knowledge in the Biological Sciences that underpin biotechnology.
- 2. Explain the fundamental concepts and techniques of biotechnology relevant to a chosen subdiscipline of the life sciences.
- 3a. Retrieve information from the life sciences literature; read, understand, and critically review scientific papers.
- 3b. Apply the scientific process, including designing and conducting experiments and testing hypotheses.
- 3c. Draw valid conclusions based on quantitative and qualitative results.
- 4. Exhibit professional and ethical behavior, including understanding of biosafety and ethical dilemmas in genetic engineering and biotechnology.

Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

Is this a degree program (undergraduate, graduate, or professional) or major proposal? No

Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

Pre-Major

Does this Program have a Pre-Major? No

Attachments

- ASC support letter for BIotechnology Science major.pdf

  (Support/Concurrence Letters. Owner: Andrews,Adam Lee)

- Proposal to Create a Biotech Science Minor.pdf

  (Program Proposal. Owner: Andrews,Adam Lee)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Andrews,Adam Lee	11/06/2025 09:18 AM	Submitted for Approval
Approved	Kulesza,Amy Elizabeth	11/06/2025 10:10 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	11/10/2025 09:46 AM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Neff,Jennifer Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	11/10/2025 09:46 AM	ASCCAO Approval

THE OHIO STATE UNIVERSITY

College of Arts and Sciences

186 University Hall
230 North Oval Mall
Columbus, OH 43210
614-292-1667 Phone
614-292-8666 Fax

artsandsciences.osu.edu

10/30/ 2025

Professor Jaime Sabel

Director, CLSE

Campus

Dear Professor Sabel,

I am writing to provide strong support for the new Biotechnology Science degree. I am well aware of how much care the initial committee and the CLSE curriculum committee have taken to position this degree so that it fits the needs of the biotechnology industry as well as sits prominently nationally relative to other competing majors in biotechnology science. I strongly believe this major will position the graduates well for outstanding initial jobs in industry and opportunities in graduate programs.

In support of this major, ASC will provide a new advisor for this new undergraduate major. I also understand that some faculty on the respective committees were concerned about potentially overwhelming our laboratory courses with the major. I commit the college to monitoring this issue and addressing the challenge if more lab courses are needed which will require more personnel.

The College of Arts and Sciences is looking forward to this new opportunity for our undergraduate students.

Sincerely,

Susan V. Olesik

Dean, Natural and Mathematical Sciences

College of Arts and Sciences

Proposal to Create a Biotech Science Minor

Center for Life Sciences Education

College of Arts & Sciences

THE OHIO STATE UNIVERSITY

CENTER FOR LIFE SCIENCES EDUCATION

Table of Contents

Proposal to create the *Biotech Science Minor*

Executive Summary

The Center for Life Sciences Education proposes a new undergraduate interdisciplinary *Biotech Science Minor* to complement the *Biotech Science Major* being concurrently proposed.

The Life Science Departments in the College of Arts & Sciences possess the expertise to support the curriculum for this Minor, and all courses but a capstone are already being taught.

The Center for Life Sciences Education has the experience and infrastructure to support an interdisciplinary Minor.

The Biotechnology industry in Ohio is booming, positioning The Ohio State University to expand upon existing partnership to provide additional co-curricular opportunities for students in addition to post-baccalaureate job opportunities.

1. General Information

- **Name of proposed minor**
  - *Biotech Science*
- **Proposed implementation date**
  - Autumn 2026
- **Academic units responsible for administrating the major program**
  - Center for Life Sciences Education, College of Arts & Sciences

2. Rationale

Modern molecular biotechnology seeks to harness the power of biological systems as solutions to address major needs and challenges of society. Biotechnology can be categorized based on the systems that are manipulated, including microbes, plants, and animals. Applications of biotechnology span multiple sectors including health, energy, agriculture, environment, and material science.[1]

[1] *ASC Biotechnology Major Committee Recommendations* Report, 5 February, 2025.

The Center for Life Sciences Education is proposing a new undergraduate interdisciplinary *Biotech Science Minor* to complement the *Biotech Science Major* being concurrently proposed. The Minor would provide undergraduate students foundational education and training to pursue careers for professions in the molecular biosciences, or advanced graduate or professional studies. This is in alignment with federal, state, and regional initiatives and recommendations. The *Biotech Science Minor* could be used to complement a wide range of Majors, including those in Business, Engineering, Mathematics, and the Life Sciences. Many of the Life Science Majors (e.g. Biology, Molecular Genetics, Biochemistry, etc) provide students with broad education within their very diverse subdisciplines. A Biotech Science Minor would serve to complement any of these Majors with an additional focus related to their discipline.

The Center for Life Sciences Education (CLSE) is the long-standing administrative home of the Biology Major at The Ohio State University, the institution's second largest Major. While the CLSE offers only the introductory biology courses and two core courses for this interdisciplinary Major and Minor, all other upper-level coursework is taught in other units. As such, the CLSE has the experience and infrastructure to offer an interdisciplinary *Biotech Science Minor* utilizing a similar structure. The CLSE's core partner departments in the College of Arts & Sciences (i.e. Department of Chemistry and Biochemistry; Department of Evolution, Ecology, and Organismal Biology; Department of Microbiology; Department of Molecular Genetics) will offer the majority of the upper-level coursework. These Core Departments already offer a large array of classes appropriate for inclusion in the Minor.

The growth of the biotechnology field both nationally and especially throughout Ohio gives The Ohio State University an ideal opportunity to train future graduates who can be retained in the state as they enter their careers in this rapidly growing field. The industry association, Ohio Life Sciences (OLS) published a report, *Ohio Life Sciences Industry Assessment and Economic Impact Report*, January 2025, which lists 4,900 biotech and life sciences-related businesses across the state, employing nearly 64,000 Ohioans providing $68.0 billion of total economic impact. The College of Arts & Science's Office of Industry Partnerships and Research Collaborations (OIPRC) has already partnered with Ohio Life Sciences (OLS), and many of Central Ohio's biotechnology-oriented firms such as Amgen, Sarepta Therapeutics, and Andelyn Biosciences. These companies and others have expressed a need for well-trained graduates that have the skills and knowledge specific to biotechnology. These already existing partnerships promise immediate opportunities to expand student placement into internships, externships, and eventual post-graduate careers. Addressing the employment needs of Ohio's biotechnology industry has been one

of the driving forces behind the development of this Minor, which will complement an array of Majors from across the University.

3. Relationship to Other Programs / Benchmarking[2]

The core structure of proposed Biotech Science Major and Minor was initially developed by a committee consisting of faculty from the four life science departments in the College of Arts & Sciences (Department of Chemistry and Biochemistry; Department of Evolution, Ecology, and Organismal Biology; Department of Microbiology; Department of Molecular Genetics), Associate Dean Andrew Martin, Assistant Dean Bernadette Vankeerbergen, and Director of Industry Research Collaborations Elizabeth Drotleff. The Committee was tasked with development of a novel structure for this Major that reflected the strengths of the Life Science Departments and paired those with the needs of the local biotech industry based on continued consultation with biotech representatives. This is the first such proposal developed within the College of Arts & Sciences.

In their exploration, the Committee found that Biotechnology programs at institutions around the country are numerous and highly variable. In thinking about the appropriate structure for a program at OSU, they evaluated 12 different biotechnology programs at R1 peer institutions across the country. This included Indiana University, Kent State, University of Houston, James Madison University, Penn State, Rutgers, Syracuse University, Tufts University, University of Georgia, University of Central Florida, UC San Diego, and UC Davis. The majority of Biotechnology Majors were housed in a college of Letters & Sciences, with others in colleges of Agriculture & Environmental Sciences (2), Engineering (2), or Medicine (1). Programs fell into three general categories: (A) those with dedicated biotechnology curriculum including introduction and capstone classes; (B) those that were an amalgam of existing courses without cohesive unity ("biotechnology in name"); or (C) heavily quantity programs akin to chemical engineering or computer science majors (these were all within Engineering).

Considering this landscape, the Committee proposed the best approach for the Biotech Science Major and Minor would be the creation of a program that includes dedicated biotechnology classes (model A), with a focused in molecular biotechnology. This provides programmatic identity that distinguishes it from other more general majors and minors, such as Biology. The foundational overlap between the proposed Biotech Science Major and Minor and other Majors across the life sciences will allow students to complement other programs with an applied Minor.

---

[2] *ASC Biotechnology Major Committee Recommendations* Report, 5 February, 2025.

The proposed *Biotech Science Minor* differs from other programs at Ohio State, such as those offered by the College of Engineering's Department of Food, Agriculture, and Biological Engineering which places heavy emphasis on the Physics and advanced Mathematics necessary for the Engineering of biotechnology. In contrast the proposed *Biotech Science Major* housed in the College of Arts & Sciences will focus on core molecular techniques, both theoretical and applied, which form the foundation of biotechnology applications with little emphasis on math or physics.

This Minor in *Biotech Science* has not been previously proposed from within the College of Arts & Sciences.

4. Student Enrollment

Given the number of supporting courses required, we anticipate the most significant interest in this Minor from students in STEM Majors, who will already overlap with most or all supporting courses. The applied nature of this Minor is likely to appeal to students Majoring in programs with a broader curriculum, such as the Biology Major, but would be equally applicable to majors such as Molecular Genetics, Microbiology, and Biochemistry, among many others in the College of Engineering, College of Medicine, College of Pharmacy, and the College of Food, Agriculture, and Environmental Science. We anticipate between 50-100 students declaring the Minor once it reaches its peak.

Given that the supporting and core courses for the Minor have large capacities and are offered every term, students will be able to declare the Minor to begin any semester. Adding to the flexibility for students, there is no set order required for students to complete the core courses.

5. Curricular Requirements

A. Program Goals & Associated Learning Outcomes

Students earning a *Biotech Science Minor* will be able to …

1. Demonstrate a strong foundational knowledge in the Biological Sciences that underpin biotechnology.
2. Explain the fundamental concepts and techniques of biotechnology relevant to a chosen subdiscipline of the life sciences.
3. Foster Research Competence and Scientific Inquiry.
    a. Retrieve information from the life sciences literature; read, understand, and critically review scientific papers.

    b. Apply the scientific process, including designing and conducting experiments and testing hypotheses.
    c. Draw valid conclusions based on quantitative and qualitative results.
4. Exhibit professional and ethical behavior, including understanding of biosafety and ethical dilemmas in genetic engineering and biotechnology.

B. Curricular Overview

In designing the curriculum, we elected for a bedrock of biology, chemistry, mathematics, and statistics universal to majors in the life sciences. An introductory course would cover essential topics such as the biotechnology origins, principles, and ethics, emphasizing intersections between science and society. The course should have broad appeal among students interested in applied molecular biosciences and serve as a gateway into the major. Biol 3501.04 (Integrated Skills in Biology: Biotechnology) will fulfill this role. The other required course will be one of four Advanced Biotechnology courses built on common learning outcomes but offered with different sub-disciplinary approaches by the four ASC Life Science Departments. These courses would be Micro 4800 (approved), MolGen 4810 and EEOB 4840 (in curricular review), and Biochem 4820 (to be developed in the near future), all of which will cover recent and significant developments in biotechnology.

Upper-division classes in general microbiology, biochemistry, evolution, and genetics will establish foundational knowledge in core scientific principles that anchor modern biotechnology. To supplement this foundation, students will select from a list of diverse electives that cover a wide range of topics related to applied molecular sciences.

The *Biotech Science Minor* will require 23-33 hours of Prerequisite Supporting Courses and a minimum 15 hours of Minor coursework. The Minor courses will be subdivided as:

- 6 hours of required Core Courses
- 6-9 hours of 'pick 2' elective coursework
- 0-3 hours of open electives

Given the wide range of elective options at variable credit hours, most students will be able to complete the Minor with exactly 15 credit hours should they choose to do so.

Following below are the details for each course that may be taken to fulfill either a Supporting or Minor course requirement for the proposed *Biotech Science Minor*. Additionally,

- The ASC Minor Advising Sheet can be found in Appendix A.
- The CLSE Minor Advising Sheet can be found in Appendix B.

- A summary of the course detail including prerequisites for each course listed can be found in Appendix C.

C. Course Details

Prerequisite Supporting Courses (23-31 credit hours)

*All courses are currently offered.

Introductory Biology Courses

Students will fulfill the Biology course requirements by completing one option from Introductory Biology 1 and one option from Introductory Biology 2. Biology 1 and Biology 2 are not sequential courses, but rather two parts of a whole.

Introductory Biology 1

- Biology 1111 and 1112:

  Biology 1111 – *Biological Foundations 1: Cells and Chemistry of Life*; 3 credit hours

  1111 Course description: An introductory exploration of life's chemical and cellular foundations, including macromolecular and cellular structure and function, energetics, pathways, the nature of scientific endeavors, and metacognitive strategies. Includes a required weekly Peer Led Team Learning Workshop. Intended for student Majoring in STEM fields. Combined with Bio 1112, these courses will address content at similar depth and breadth as Bio 1113x.

  Prereq or concurrent: Math 1075 or 1120. Not open to students with credit for 1113x

  AND

  Biology 1112 – *Biological Foundations 2: Molecular Machinery & Genetics*; 4 credit hours

  1112 Course description. An introductory exploration of life's cellular and genetic mechanisms, molecular biology, and metacognitive strategies. Includes a required weekly Peer Led Team Learning Workshop. Intended for student Majoring in STEM fields. Combined with Bio 1111, these courses will address content at similar depth and breadth as Bio 1113x.

  Prereq: 1111; Prereq or concurrent: Math 1121 or 1148. Not open to students with credit for 1113x.

OR

- Biology 1113.01: *Biological Sciences: Energy Transfer and Development*; 4 credit hours

  Course description. Exploration of biology and biological principles; evolution and the origin of life, cellular structure and function, bioenergetics, and genetics. A broad introduction to biology comprises both Biology 1113 and 1114. Lecture, Lab.

  Prereq: Math 1120, 1130, 1148, 1150, or above, or Math Placement Level L or M. Prereq or concur: Chem 1110, 1210, 1610, or 1910H, or permission of course coordinator. Not open to students with credit for 1113 or 1113.02.

OR

- Biology 1113.02 – *Biological Sciences: Energy Transfer and Development PLTL*; 5 credit hours

  Course Description. Exploration of biology and biological principles; evolution and the origin of life, cellular structure and function, bioenergetics, and genetics. This course includes a required Peer-Led Team Learning (PLTL) component. Peer-led team learning (PLTL) provides a structure within which students will actively work together in groups to complete a series of activities and deepen their understanding of concepts associated with Biology 1113. A peer leader will work with the group on challenging and relevant activities to prepare biology students to apply scientific reasoning to authentic problems.

  Prereq: Math 1120, 1130, 1148, 1150, or above, or Math Placement Level L or M. Prereq or concur: Chem 1110, 1210, 1610, or 1910H, or permission of course coordinator. Not open to students with credit for 1113 or 1113.01.

Introductory Biology Course 2

- Biology 1114.01 – *Biological Sciences: Form, Function, Diversity, and Ecology*; 4 credit hours

  Course description.; Exploration of biology and biological principles; evolution and speciation, diversity in structure, function, behavior, and ecology among prokaryotes and eukaryotes. A broad introduction to biology comprises both Biology 1113 and 1114.; Lecture, Lab.

  Prereq: Math 1120, 1130, 1148, or 1150 or above, or Math Placement Level L or M. Prereq or concur: Chem 1110, 1210, 1610, or 1910H, or permission of course coordinator. Not open to students with credit for 1114 or 1114.02.

OR

- Biology 1114.02 – *Biological Sciences: Form, Function, Diversity, and Ecology PLTL*; 5 credit hours

  Exploration of biology and biological principles; evolution and speciation, diversity in structure, function, behavior, and ecology among prokaryotes and eukaryotes. This course includes a required Peer-Led Team Learning (PLTL) component. Peer-led team learning (PLTL) provides a structure within which students will actively work together in groups to complete a series of activities and deepen their understanding of concepts associated with Biology 1114. A peer leader will work with the group on challenging and relevant activities to prepare biology students to apply scientific reasoning to authentic problems.

  Prereq: Math 1120, 1130, 1148, or 1150 or above, or Math Placement Level L or M. Prereq or concur: Chem 1110, 1210, 1610, or 1910H, or permission of course coordinator. Not open to students with credit for 1114 or 1114.01.

Mathematics/Statistics Courses

Students will fulfill this requirement by completing one of the following:

- Math 1148 and Math 1149
- Math 1148 and Stat 1450
- Math1150 or higher

Course Details:

- Math 1148 – *College Algebra*; 4 credit hours
  Functions: polynomial, rational, radical, exponential, and logarithmic. Introduction to right-angle trigonometry. Applications.
  Prereq: A grade of C- or above in 1075, or credit for 104 or 148, or Math Placement Level N, or ACT math subscore of 22 or higher that is less than 2 years old, or permission of department. Not open to students with credit for 1144, or for Math courses numbered 1150 (150) or above.

AND

- Math 1149 – *Trigonometry*; 3 credit hours
  Trigonometric functions and their properties. Vectors, polar coordinates and complex numbers.
  Prereq: A grade of C- or above in 1148, or permission of department. Not open to students with credit for 1144, or for any Math course numbered 1150 (150) or above.

OR

- Stat 1450x – *Introduction to the Practice of Statistics*; 3 credit hours
  Algebra-based introduction to data analysis, experimental design, sampling, probability, inference, and linear regression. Emphasis on applications, statistical reasoning, and data analysis using statistical software.
  Prereq: Math 1116 or 1130 or above, or Math Placement Level L or M, or permission of instructor

OR

- Math 1150 – *Precalculus*; 5 credit hours
  Functions: polynomial, rational, radical, exponential, logarithmic, trigonometric, and inverse trigonometric. Applications.
  Prereq: Math Placement Level M. Not open to students with credit for 1144, 1148, or for 1149 or above, or for any quarter Math course numbered 150 or above.

General Chemistry Courses

Students will fulfill the General Chemistry course requirement by completing one option from General Chemistry Course 1 and one option from General Chemistry Course 2. The chemistry courses have specific sequences for students and are not interchangeable.

- Chem (1206 and 1208) or 1210 => Chem 1220
- Chem 1610 => 1620
- Chem 1910H => 1920H

General Chemistry Course 1

- Chem 1206 and 1208

  Chem 1206 – *Foundations 1 of General Chemistry*; 3 credit hours

  Chem 1206 is the first course in a two-course series, for science majors, covering units & measurement, atomic structure, electron configuration, periodic trends, bonding, and molecular structure. The chemistry content is covered in the same depth and rigor as in Chem 1210, and is about 1/2 of the Chem 1210 content. Additionally, metacognitive learning strategies are taught in the course.

  Prereq or concur: Math Placement Level L or M, Math 1120, 1130, 1131, 1140, 1148, 1150, or above

  AND

  Chem 1208 – *Foundations 2 of General Chemistry*; 4 credit hours

  CHEM 1208 is second course in a two-course series, for science majors, covering the mole, stoichiometry, chemical reactions, thermochemistry, gases, liquids, and

solids, paired with metacognitive learning strategies. CHEM 1208 also includes a laboratory experience, that covers labs from both CHEM 1206 and CHEM 1208 content. Credit for CHEM 1206 and CHEM 1208 is equivalent to CHEM 1210.

Prereq: Chem 1206, and a grade of C- or above in Math 1120, 1130, 1131, 1140, 1148, 1150, or above

OR

- Chem 1210 – *General Chemistry 1*; 5 credit hours
  First course for science majors, covering dimensional analysis, atomic structure, the mole, stoichiometry, chemical reactions, thermochemistry, electron configuration, bonding, molecular structure, gases, liquids, and solids.
  Prereq: One unit of high school chemistry, and Math Placement Level L or M; or a grade of C- or above in Math 1120, 1130, 1131, 1148, 1150, or above

OR

- Chem 1610 – *General Chemistry for Majors 1*; 5 credit hours
  First course for chemistry and biochemistry majors, covering dimensional analysis, atomic structure, the mole, stoichiometry, chemical reactions, thermochemistry, electron configuration, bonding, molecular structure, gases, liquids, and solids.
  Prereq: One unit of high school chemistry, and Math Placement Level L or M; or a grade of C- or above in Math 1120, 1130, 1131, 1148, or 1150, or above, and enrolled in Chemistry or Biochemistry major; or permission of department

OR

- Chem 1910H – *Honors General Chemistry 1*; 5 credit hours
  Fundamental chemical principles and the chemistry of nonmetals for selected students.
  Prereq: ACT composite score of 30 or above, and ACT mathematics score of 30 or above, and ACT science reasoning score of 28 or above. Prereq or concur: Math 1141 or 1151 or above, or permission of instructor

General Chemistry Course 2

- Chem 1220 – *General Chemistry 2*; 5 credit hours
  Continuation of 1210 for science majors, covering solutions, kinetics, chemical equilibrium, solubility and ionic equilibria, qualitative analysis, thermodynamics, electrochemistry, descriptive chemistry, coordination compounds, and nuclear chemistry.
  Prereq: 1210, 1215, 1250, 1610, or 1910H, and Math Placement Level L or M, or a grade of C- or above in Math 1120, 1130, 1131, 1148, or 1150, or above; or credit for both Chem 1206 and 1208.

OR

- Chem 1620 – *General Chemistry for Majors 2*; 5 credit hours
  Continuation of 1610 for science majors, covering solutions, kinetics, chemical equilibrium, solubility and ionic equilibria, qualitative analysis, thermodynamics, electrochemistry, descriptive chemistry, coordination compounds, and nuclear chemistry.
  Prereq: 1210, 1215, 1250, 1610, or 1910H; and a grade of C- or above in Math 1120, 1130, 1131, 1148, or 1150, or above, or Math Placement Level L or M; and enrollment in Chemistry or Biochemistry major; or permission of department

OR

- Chem 1920H – *Honors General Chemistry 2*; 5 credit hours
  Continuation of Chem 1910H for selected students covering fundamental principles and the chemistry of metals.
  Prereq: 1910H (202H). Not open to students with credit for 203H, 1220 or 1620

Core Course Requirements (6 credit hours)

- Bio 3501.04 – *Integrative Skills in Biology: Biotechnology*; 3 credit hours
  A biotechnology themed integrative approach to fundamental skills enhancement in the life sciences. *Note that this course is designed around and satisfies the Advanced Writing, Data Analysis, and Technology Embedded Literacies*.
  Prereq: 1113, 1114, and Chem 1220; or permission of instructor

AND

- Biochem 4820 – To Be Developed; 3 credit hours

OR

- EEOB 4840 – *Biodiversity Biotechnology*; 3 credit hours(in curricular review)
  Study of the properties and use of organisms that are relevant to biotechnology from an ecological and evolutionary perspective, including structural and chemical properties of organisms, communities and microbiomes, biomaterials and bio-inspired design, bioprospecting, GMOs, and conservation implications.

OR

- Micro 4800 – *Advances in Microbial Biotechnology*; 3 credit hours
  Lecture course covering topics in applied microbial biotechnology, biocatalysis, and chemical biology. The origins of modern biotechnology, impact of microbial chemicals, and significant developments in biotechnology will be discussed.
  Prereq: MICRBIO 4100; or BIOCHEM 4511 or 5613; or PHR 3200

OR

- MolGen 4810 – *Advances in Genetic Biotechnology*; 3 credit hours (in curricular review)
  This upper-level course explores recent breakthroughs and emerging technologies in the field of biotechnology, with a focus on biotechnology in the genetic sector.

Topics will include regulation of gene expression, genome editing technologies (CRISPR and beyond), synthetic biology, use of microbial and cellular systems in the discovery of natural compounds and the production of commodity chemicals, and applications in medicine and agriculture. Students will engage with primary literature and learn to critically evaluate cutting-edge research, providing foundational knowledge and skills for careers in biotechnology and beyond.
Prereq: Completion of MolGen4500 or MolGen4606 with a grade of C- or higher, or permission of instructor

Minor 'Pick 2' Elective Courses (6-9 credit hours)

*All courses currently offered

To fulfill this requirement, students will pick one course from each of two disciplines.

Biochemistry Course

- Biochem 4511 – *Introduction to Biological Chemistry*; 4 credit hours
  An introductory course in biochemistry dealing with the molecular basis of structure, metabolism, genetic replication, transcription, and translation in plants, animals, and microorganisms.
  Prereq: Chem 1220, 1250, 1620, or 1920H, and 2510, 2310, 2610, or 2910H and one semester of Biological Sciences

OR

- Biochem 5613 – *Biochemistry and Molecular Biology 1*; 3 credit hours
  An introductory course in biochemistry and molecular biology developing in three semesters the molecular basis of structure and function of living cells.
  Prereq: Chem 2510 (252), 2610, or 2910H. Prereq or concur: Chem 2520 (253), 2620, or 2920H, and one semester in Biological Sciences

Evolution Course

- EEOB 3310.01 (4 credit hour lecture)
  Basic conceptual issues and processes in evolution with an emphasis on the ecological basis of adaptation and consequences of natural selection. Also available summer term at Stone Lab.
  Prereq: Biology 1114 or 1114H, or permission of instructor

OR

- EEOB 3310.02 (4 credit hour hybrid lecture and laboratory)
  This course surveys the many processes that underlie biological evolution and illustrates the patterns they generate, with a focus on adaptation, types of selection,

population genetics, species interactions and biodiversity. This course is presented in a hybrid online format.
Prereq: Biology 1114 or 1114H, or permission of instructor.

OR

- EEOB 3310.20 (3 credit hour lecture)
  This course surveys the many processes that underlie biological evolution and illustrates the patterns they generate, with a focus on adaptation, types of selection, population genetics, species interactions and biodiversity. This course is presented in a hybrid online format.
  Prereq: Biology 1114.01 or 1114H; or permission of instructor.

Microbiology Course

- Micro 4000x – *Basic and Practical Microbiology*; 4 credit hours
  Provides an understanding of microorganisms and their interaction with the human experience.
  Prereq: 3 cr hrs in Biology. Not open to students with credit for 4000 or 4000.02.

OR

- Micro 4100 – *General Microbiology*
  Fundamental principles of microbiology and the characteristics of microorganisms with emphasis on their structure, molecular biology, growth, classification, physiology, ecology, biotechnology, ecology, and applied microbiology.
  Prereq: Biology 1113, or 1113H, and Chem 1220.

Molecular Genetics Course

- MolGen 4500.x – *General Genetics*; 3 credit hours
  The principles of genetics, including molecular genetics, transmission genetics of prokaryotes and eukaryotes, developmental and non-chromosomal genetics, recombinant DNA and genomics, and the genetics and evolution of populations.
  Prereq: Biology 1101, 1113, or 1113H, and 3 additional sem cr hrs in Biological Sciences

OR

- MolGen 4606 – *Molecular Genetics*; 4 credit hours
  A comprehensive genetics course for majors covering transmission and molecular genetics; DNA replication, repair and mutation; transcription and translation; analysis and manipulation of genes at the molecular level.
  Prereq: Biology 1113 (113), 1113H (115H), 1114 (114), 1114H (116H), or Chem 1210 (121) or equiv, or permission of instructor

Additional Minor Elective Courses (0-3 credit hours)

*All courses currently offered, except as noted.

Advanced Laboratory Course Electives

- Biochem 5621 – *Biochemistry and Molecular Biology Laboratory*; 4 credit hours
  Laboratory course covering the principles and application of basic lab techniques, protein purification, enzyme assays, and recombinant DNA technologies.
  Prereq: A grade of C- or above in 4511 or 5613, or equiv.
- Micro 4140 – *Molecular Microbiology Laboratory*; 3 credit hours
  Advanced laboratory covering structure, maintenance, expression and exchange of genetic materials in microbial cells and methods in immunobiology.
  Prereq or concur: Micrbio 4130
- Micro 4145 – *Introduction to Industrial Microbiology and Bioprocessing Laboratory*; 3 credit hours
  Discovery-based lab course to introduce students to industrial microbiology. Students will use fermentation processes and biological engineering of microorganisms for the production of value-added molecules. Students will gain operational knowledge of bioreactors and of molecular biology and microbiology techniques relevant to industrial microbiology.
  Prereq: 4100, or 4000.01, 4000.02; or permission of instructor
- Micro 4150 – *Immunobiology Laboratory*; 3 credit hours
  This course will provide an introduction to the experimental approaches and laboratory methods commonly used in Immunology research. Topic areas include the purification, characterization and applications of antibodies, the characterization and responses of cells and organs of the immune system, and cell culture techniques for the use of eukaryotic cells in immunology research.
  Prereq: 4110, or 5122, or permission of the Instructor.
- MolGen 5601 – *Eukaryotic Molecular Genetics Lab*; 3-4 credit hours
  Current laboratory techniques used in the genetic, cellular, and molecular analyses of yeast, Drosophila, and other model systems.
  Prereq: 4500 or 4606, or permission of instructor.
- MolGen 5602 – *Eukaryotic Cell and Developmental Biology Laboratory*; 3-4 credit hours
  Laboratory course emphasizing techniques and methods central to cell and developmental biology of eukaryotes.
  Prereq: 4500 or 4606; or permission of instructor.

Minor Course Electives

- Micro 4891 – Progress in Biotechnology (to be cross-listed with Biochem/EEOB/MolGen); 1 credit hour
  Students will gain insight into real-world applied molecular sciences and biotechnology research through seminars presented by industry scientists; bi-weekly discussions will facilitate understanding of core research principles presented in seminars through shared reflection and discussion of research articles relevant to seminars.
  Prereq: Microbiology 4100; or Biochemistry 4511 or 5613; or Pharmacy 3200
- Biochem 5721 – *Physical Biochemistry 1*; 3 credit hours
  Introduction to physical chemistry with emphasis on biological applications; designed for students in the life sciences.
  Prereq: Biology 1113; Math 1152 (153), 1172, 1181H, or 2162 (162); and Physics 1201 (113) or 1251 (133). Prereq or concur: Chem 2520 (253), 2620, or 2920H.
- Biochem 5722 – *Physical Biochemistry 2*; 3 credit hours
  Continuation of Biochem 5721.
  Prereq: 5721, or Chem 4200 or 4300.
- Chem 5230 – *Neurotransmitter Chemistry*; 3 credit hours
  Come and explore the natural and unnatural organic molecules involved in neurotransmission. Through the study of synthetic strategies, mechanistic principles, and the structural requirements for biological activity, students will investigate the chemical world of endogenous molecules, pharmaceuticals, and drugs of abuse. Recommended prereqs: Chem 2550, and Biochem 4511 or 5613.
  Prereq: 2520, 2620, or 2920H, and 2540; or Grad standing; or permission of instructor.
- Chem 5240 – *Introduction to Protein Modeling*; 3 credit hours
  This course provides a practical introduction to the theory and methods of molecular modeling and computational chemistry as it pertains to modeling large biological molecules such as proteins. Hands-on experience will be obtained by all attendees in doing molecular mechanics and modeling dynamic systems (molecular dynamics). Recommended prereq: Biochem 4511.
  Prereq: 2310, 2510, 2610, or 2910H; or Grad standing; or permission of instructor.
- Chem 5430 – *Carbohydrate Chemistry*; 3 credit hours
  Introduction to synthesis, conformation, and biological importance of carbohydrates and oligosaccharides, including nomenclature, protecting groups, glycoside synthesis, biosynthesis and biology, and NMR methods.
  Prereq: 2520 (253), 2620, or 2920H (253H), or equiv.

- EEOB 2511 – Human Anatomy; 4 credit hours
  This introductory course in human anatomy introduces students to the principles of vertebrate anatomy with emphasis on human systems. Weekly laboratory meetings provide students with experience dissecting a small mammal as a model for human organ systems.
  Prereq: 3 sem cr hrs in Biological Sciences.
- EEOB 3310.22 – *Evolution (Laboratory)*;1 credit hour
  This course surveys the many processes that underlie biological evolution and illustrates the patterns they generate, with a focus on adaptation, types of selection, population genetics, species interactions and biodiversity. This course is a laboratory course intended to be taken concurrently with EEOB 3310.20 or by students with credit in EEOB 3310.20.
  Prereq or concur: 3310.01 or 3310.20
- EEOB 3320 – *Organismal Diversity*; 3 credit hours
  A survey of organismal diversity and the evolutionary relationships between and within major groups of organisms. Class is laboratory based.
  Prereq: 3310.
- EEOB 3410 – *Ecology*; 4 credit hours
  Distribution and abundance of species, population dynamics, community ecology, ecosystem dynamics, and applied perspectives. Also available summer term at Stone Lab.
  Prereq: Biology 1114 or 1114H, or permission of instructor.
- EEOB 3510 – *Cellular and Developmental Biology*; 3 credit hours
  Introduction to the structure and function of animal cells, and to patterns of early development in vertebrates and invertebrates.
  Prereq: 3310, and Biology 1113 or 1113H
- EEOB 3610 – *Evolutionary Genomics*; 3 credit hours (in curricular review)
  An introduction to core principles of the modeling and investigation of biological data using quantitative models applied to genomic and other data. The course focuses on applications of quantitative modeling methods to study of the evolution and ecology to natural populations of animals, plants, and fungi.
  Prereq: Recommend a working knowledge of molecular genetics, inheritance genetics, and basic statistics. No specific course is required as a formal prerequisite.
- EEOB 4520 – *Comparative Physiology*; 4 credit hours
  Functional systems in invertebrates and vertebrates: respiration, circulation, water, ion, and energy balance; communication; locomotion; and reproduction.
  Prereq: Biology 1114 or 1114H, and 1 course in Biological Sciences.

- EEOB 4560 – *Comparative Endocrinology*; 2 credit hours
  Introduction to hormones and hormone action; comparison between vertebrates and invertebrates with emphasis on special situations such as metamorphosis.
  Prereq: 4520 and Biochem 4511, or equiv, or permission of instructor.
- EEOB 5360 – *Biodiversity Informatics*; 3 credit hours
  This course will provide students with the knowledge and practical skills to access, manage, analyze, and utilize biodiversity data for scientific research and conservation efforts. The course covers a comprehensive understanding of diverse biodiversity data sources and introduces a range of analytical, statistical, and computational tools essential for biodiversity data analysis.
  Prereq: 3410, or 3310.01, or 3310.02; or permission of instructor.
- Micro 2100 – *Wild Yeast: Isolation to Fermentation*; 3 credit hours
  An introduction to yeast biology and microbiological techniques used in fermentation. Students will isolate an unknown yeast from the environment and characterize the growth behavior of the wild strains; use molecular biology and bioinformatics to determine the yeast species they have isolated; use the wild yeast to prepare a fermentation and characterize the finished 'wild' ferment.
  Prereq: Biology 1110 or 1113, and Chem 1110, 1210, or 1610; or permission of instructor.
- Micro 4110 – *Microbial Pathogenesis and Immunobiology*; 3 credit hours
  Provides an overview of microbe-host interactions with an emphasis on virulence mechanisms of bacterial pathogens, host infection routes, immune recognition of microbes, and the cellular and molecular effectors of the host immune system.
  Prereq: 4000 (509) or 4100 (520)
- Micro 4120 – *Microbial Physiology and Diversity*; 3 credit hours
  Principles of microbial growth, metabolism, microbial structure and function, and regulation of microbial metabolism.
  Prereq: 4100. Prereq or concur: Biochem 4511.
- Micro 4130 – *Microbial Genetics*; 3 credit hours
  Structure, maintenance, expression, and exchange of genetic materials in microbial cells.
  Prereq: 4100, MolGen 4500, or 4606.
- Micro 5161 – *Introduction to Computational Genomics*; 3 credit hours
  Application of computational tools to the analysis of microbial genomes and their gene products. Recommended background in basic molecular biology, genetics or biochemistry.

- MolGen 3436 – *Introductory Plant Physiology*; 3 credit hours
  Topics in plant physiology at the introductory level: diffusion, transpiration, water stress, translocation, photosynthesis, plant growth hormones, tropisms, flowering, and fruit development.
  Prereq: Biology 1113, 1113H, 1114, 1114H, and 6 cr hrs in Chem.
- MolGen 4700 – *Molecular Cell and Developmental Biology*; 3 credit hours
  A genetics-based introduction to the structure and function of cells and the early development of invertebrates and vertebrates, with a special focus on the molecular mechanisms underpinning cellular biology and development.
  Prereq: 4500 or 4606, or permission of instructor.
- MolGen 4703 – *Human Genetics*; 3 credit hours
  This course covers principles of human genetics, including mapping and identification of disease genes, animal models, genetic testing and gene therapy, with a focus on reading the primary scientific literature.
  Prereq: A grade of C- or above in 4500 or 4606, or permission of instructor.
- MolGen 5300 – *Cancer Genetics*; 3 credit hours
  Students will learn about the genetic evolution of human cancer. Specifically, the hallmarks of cellular transformation and tumor progression will be discussed. Students will be introduced to modern approaches aimed at targeting genetic aberrations in cancer cells. Includes hands-on training in the use of online databases of cancer genetics.
  Prereq: A grade of C- or above in 4606 or 4500; or Grad standing.
- MolGen 5607 – *Cell Biology*; 3 credit hours
  Analysis of the structure and function of animal and plant cells and their components, stressing molecular genetic and biochemical approaches.
  Prereq: 4500 or 4606. Not open to students with credit for 607, 607H, 5607E.
- MolGen 5607E – *Cell Biology with Embedded Honors*; 4 credit hours
  Analysis of the structure and function of animal and plant cells and their components, stressing molecular genetic and biochemical approaches.
  Prereq: 4500 or 4606. Not open to students with credit for 607, 607H, 5607E.
- MolGen 5623 – *Genetics and Genomics*; 3 credit hours
  Advanced study of plant physiology; regulation of plant growth and development, hormones, and stress physiology.
  Prereq: 3300, 4500, 4606, Biology 1114, 1114H, or permission of instructor.
- MolGen 5650 – *Analysis and Interpretation of Biological Data*; 3 credit hours

Methods of analyzing biological data including: sampling, descriptive statistics, distributions, analysis of variance, inference, regression, and correlation. Emphasizes practical applications of statistics in the biological sciences.
Prereq: Math 1149 or 1150 (150) or equiv, and 10 semester cr hrs at the 3000-level (or 300 level in the quarter system) or above in Agricultural or Biological Sciences.

- MolGen 5701 – *DNA Transactions and Gene Regulation*; 3 credit hours
  Understanding mechanisms of DNA replication, DNA repair and recombination, transcription, translation, regulation of gene expression, and the experimental approaches to these topics.
  Prereq: 4500, 4606, Biochem 4511, or equiv., and Sr standing; or Grad standing; or permission of instructor. Not open to students with credit for Biochem 5701. Cross-listed in Biochem.
- MolGen 5800 – Organelle Biology; 2 credit hours
  Structure and function of plastids and mitochondria, apicoplasts and hydrogenosomes.
  Prereq: 4500, 4500E, or 4606, or permission of instructor.
- MolGen 5xxx – *Genome Analysis*; (to be developed)

D. Summary of Departmental Contributions

The Center for Life Sciences Education will be responsible for the administration, advising, and assessment for the interdisciplinary *Biotech Science Minor* as well as offering courses listed under the Biology catalog.

The table below outlines the total credit hours counting toward the degree requirement as offered by each associated unit.

Unit	Required / Core Credits		Open Elective Credits	
	Lower Level	Upper Level	Lower Level	Upper Level (*Students will select 6-10 hours total)
Biology (CLSE)	8-10	3	0	0
Chemistry and Biochemistry	10-12	3-7	0	19
Evolution, Ecology, and Organismal Biology	0	3-7	0	30
Mathematics	4-7	0	0	0
Microbiology	0	4-8	0	24
Molecular Genetics	0	3-7	0	35-38
Statistics	0-3	0	0	0

E. Additional Resources Required

Four Departments (Chemistry and Biochemistry, EEOB, Microbiology, and Molecular Genetics) have or will each be developing a new course (48xx – *Advanced Biotechnology*) and a cross-listed seminar course (Micro 4891- *Seminar*) and staffing those courses from within their own faculty. EEOB has plans to develop one additional new course, EEOB 3610 – *Evolutionary Genomics* as an elective offering, while Molecular Genetics will be developing MolGen 5xxx – *Genome Analysis*. Beyond those courses, no new offerings are currently planned to facilitate the implementation of this Major. Student demand for electives will be monitored and additional sections proposed as appropriate. Given that all other courses are currently offered, no additional course resources beyond appropriate staffing are necessary at this time.

Appendix A: ASC Minor Advising Sheet

ASC Minor Advising Sheet
The Ohio State University
College of Arts and Sciences
Biotech Science ([SIS minor code][2])

Center for Life Sciences Education Academic Advising;
biology@osu.edu; 614-292-1704

Modern molecular biotechnology seeks to harness the power of biological systems as solutions to address major needs and challenges of society. Biotechnology can be categorized based on the systems that are manipulated, including microbes, plants, and animals. The Biotech Science Minor will build on foundational principles of the life sciences with an applied approach to molecular biotechnology, as applicable to engagement with the modern biotech industry.

Biotech Science Curricular Information

Required prerequisites (5-7 courses, 23-31 CH)
1. Biology 1113.xx(H)(E) (4-5) and 1114.xx(H)(E) (4-5)
-OR- Biology 1111 (3), 1112 (4) and 1114.xx(H)(E) (4-5)
-AND-
2. Chemistry 1210 (5) and 1220 (5)
-OR- Chemistry 1206 (3), 1208 (4) and 1220 (5)
-OR- Chemistry 1610 (5) and 1620 (5)
-OR- Chemistry 1910H (5) and 1920H (5)
-AND-
3. Math 1148 (4) and Statistics 1450 (3)
-OR- Math 1148 (4) and 1149 (3)
-OR- Math 1150 (5) or higher

The Biotech Science Minor consists of 15 credit hours beyond the prerequisites listed above. The minor includes courses that present fundamental topics in biology, including biochemistry, anatomy, physiology, genetics, microbiology, ecology, and evolution. Students must take two core courses, choose two courses from among three foundational areas, and then may choose from additional electives as necessary.

Required core course (2 courses, 6 CH)
Choose one of the following options:
1. Biology 3501.04 (3) – Integrative Skills in Biology: Biotechnology
-AND-
2. Biochem 4820 or EEOB 4840 or Micro 4800 or MolGen 4810 (3)

Additional required courses (2 courses, 6-9 CH)
Choose one course from each of two disciplines:

- Biochem 4511 (4) or 5613 (3)
  EEOB 3310.01 or 3310.02 (4) or 3310.20 (3)
- Micro 4000 (4)* or Micro 4100 (5)
- MolGen 4500 (3) or 4606 (4)

Elective Course Options (0-3 CH)
Biochem/Micro/MolGen 4891 (1)

Biochem 5721 (3)	Biochem 5722 (3)	
Chem 5230 (3)	Chem 5240 (3)	Chem 5430 (3)
EEOB 2511† (4)	EEOB 3310.22† (1)	EEOB 3320† (3)
EEOB 3410† (4)	EEOB 3510 (3)	EEOB 3610 (3)
EEOB 4520 (4)	EEOB 4560 (2)	EEOB 5360 (3)
Micro 2100† (3)	Micro 4110 (3)	Micro 4120 (3)
Micro 4130 (3)	Micro 5161 (3)	
MolGen 3436	MolGen 4700 (3)	MolGen 4703 (3)
MolGen 5300 (3)	MolGen 5607/5607E (3-4)	MolGen 5623 (3)
MolGen 5650 (3)	MolGen 5701 (3)	MolGen 5800 (2)
MolGen 5xxx (3)		

Biotech Science Minor Guidelines

Credit hours required: A minimum of 15 CH. 1000-level courses shall not be counted in the minor. At least 6 CH must be upper-level courses as defined by the College of Arts and Sciences.

Transfer and EM credit hours allowed: A student is permitted to count up to 6 total hours of transfer credit and/or credit by examination.

Overlap with the GE: A student is permitted to overlap up to 6 credit hours between the GE and the minor.

Overlap with the major and additional minor(s):
- The minor must be in a different subject than the major.
- The minor must contain a minimum of 12 hours distinct from the major and/or additional minor(s).

Grades required:
- Minimum C- for a course to be counted on the minor, except Micro 4000x, which requires an A or A-.
- Minimum 2.00 cumulative GPA for all minor course work.
- Course work graded Pass/Non-Pass cannot count on the minor
- No more than 3 credit hours of course work graded Satisfactory/Unsatisfactory may count toward the minor

X193 credits – No more than 3 credit hours.

Declaring the minor
In order to declare the minor, students must meet with an academic advisor in the Center for Life Sciences Education prior to the filing of the graduation application. Please call 614-292-1704 to make an appointment.

Approval of Coursework
Initial approval of the minor coursework:
Students should obtain a signed minor program form from the Center for Life Sciences Education that outlines their planned coursework. If a student's coursework changes after this form has been completed, additional approval(s) may be required. Please call 614-292-1704 to make an appointment with an academic advisor for further guidance.

Approval for courses not listed on this form to apply to the minor program:
Students must obtain the approval of the Center for Life Sciences Education to apply courses not listed on this form toward the Biology minor. Please call 614-292-1704 to meet with a CLSE advisor and begin the approval request process.

Appendix B: Biotech Science Minor Advising Sheet

Biotech Science Minor Checklist

NAME_____ DATE_____

SEMESTER OF GRADUATION _____

Required Supporting Courses (23-31 credit hours)

Biology (Check 2 boxes)

- ❒ Biology 1113.01 (4) OR 1113.02 (5) or Biology 1111 (3) and 1112 (4)
- ❒ Biology 1114.01 (4) OR 1114.02 (5)*
- ❒ _____Substitution

* Can be used to fulfill the GEN Foundation: Natural Sciences requirement

Mathematics/Statistics (Check 1 box)

- ❒ Math 1148 (4)** AND Math 1149 (3), OR Math 1148 (4)** AND STAT 1450 (3), OR Math 1150 (5)**
- ❒ _____Substitution

** Can be used to fulfill the GEN Foundation: MQRM requirement

Chemistry (Check 2 boxes)

- ❒ Chemistry 1206 (3) AND 1208 (4), OR 1210, OR 1610, OR 1910H (5)
- ❒ Chemistry 1220, OR 1620, OR 1920H (5)
- ❒ _____Substitution

Core Course (6 credit hours) – Required (Check 2 boxes)

- ❒ Biology 3501.04 (3) – *Integrative Skills in Biology: Biotechnology*
- ❒ Biochem 4820 or EEOB 4840 or Micro 4800 or MolGen 4810 (3)

Biotech Science Minor (6-9 credit hours)

Additional Required Courses (Check 2 boxes)

- ❒ Biochem 4511 (4) or 5613 (3)
- ❒ EEOB 3310.01 or 3310.02 (4) or 3310.20 (3)
- ❒ Micro 4000† (4) or Micro 4100† (5)
- ❒ MolGen 4500x (3) or 4606 (4)

Electives (0-3 credit hours)

Advanced Lab Course Electives

- ❒ Biochem 5621† (4)
- ❒ Micro 4140† (3)
- ❒ Micro 4145† (3)
- ❒ Micro 4150† (3)
- ❒ MolGen 5601† (3-4)
- ❒ MolGen 5602† (3-4)

Open Electives

- ❒ Micro 4891 (1)
- ❒ Biochem 5721 (3)
- ❒ Biochem 5722 (3)
- ❒ Chem 5230 (3)
- ❒ Chem 5240 (3)
- ❒ Chem 5430 (3)
- ❒ EEOB 2511† (4)
- ❒ EEOB 3310.22† (1)
- ❒ EEOB 3320† (3)
- ❒ EEOB 3410† (4)
- ❒ EEOB 3510 (3)
- ❒ EEOB 3610 (3)
- ❒ EEOB 4520 (4)
- ❒ EEOB 4560 (2)
- ❒ EEOB 5360 (3)
- ❒ Micro 2100† (3)
- ❒ Micro 4110 (3)
- ❒ Micro 4120 (3)
- ❒ Micro 4130 (3)
- ❒ Micro 5161 (3)
- ❒ MolGen 3436 (3)
- ❒ MolGen 4700 (3)
- ❒ MolGen 4703 (3)
- ❒ MolGen 5300 (3)
- ❒ MolGen 5607/5607E (3-4)
- ❒ MolGen 5623 (3)
- ❒ MolGen 5650 (3)
- ❒ MolGen 5701 (3)
- ❒ MolGen 5800 (2)
- ❒ MolGen 5xxx (3)

TOTAL BioSci HOURS		TOTAL SEMESTER UNITS	

† Courses with a laboratory component

Biotech Science Minor Checklist

Notes:

- Core, required, and elective courses must total at least 15 semester units.
- 15 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics. Courses outside these departments must be pre-approved by a Biotechnology advisor.
- Transfer credit is allowed - no more than six of the credit hours required on the minor.
- Honors versions of courses substitute freely.
- No grade below a C- will be permitted in courses constituting the minor. The minimum overall cumulative point-hour ratio of the minor shall be 2.00. Courses taken on a Pass/Non-Pass (PA/NP) basis may not be applied to the minor.
- Each minor completed must contain a minimum of 12 hours distinct from the major and/or additional minors, so only 3 credit hours from this Minor may overlap with a Major or additional Minor.
- 6 credit hours are permitted to overlap between the GE and a minor.

Appendix C: Summary of Course Details

Catalog Number	Course Name	Credit Hours	Prerequisites
Prerequisite Supporting Courses			
Biology 1111	*Biological Foundations 1: Cells and Chemistry of Life*	3	Prereq or concurrent: Math 1075 or 1120
Biology 1112	*Biological Foundations 2: Molecular Machinery & Genetics*	4	1111; Prereq or concurrent: Math 1121 or 1148
Biology 1113x	*Biological Sciences: Energy Transfer and Development*	4-5	Math 1120, 1130, 1148, 1150, or above, or Math Placement Level L or M. Prereq or concur: Chem 1110, 1210, 1610, or 1910H, or permission of course coordinator
Biology 1114x	*Biological Sciences: Form, Function, Diversity, and Ecology*	4-5	Math 1120, 1130, 1148, or 1150 or above, or Math Placement Level L or M. Prereq or concur: Chem 1110, 1210, 1610, or 1910H, or permission of course coordinator
Math 1148	*College Algebra*	4	A grade of C- or above in 1075, or credit for 104 or 148, or Math Placement Level N, or ACT math subscore of 22 or higher that is less than 2 years old, or permission of department
Math 1149	*Trigonometry*	4	A grade of C- or above in 1148, or permission of department.
Math 1150	*Precalculus*	5	Math Placement Level M.
Stat 1450x	*Introduction to the Practice of Statistics*	3	Math 1116 or 1130 or above, or Math Placement Level L or M, or permission of instructor
Chem 1206	*Foundations 1 of General Chemistry*	3	Prereq or concur: Math Placement Level L or M, Math 1120, 1130, 1131, 1140, 1148, 1150, or above
Chem 1208	*Foundations 2 of General Chemistry*	4	Chem 1206, and a grade of C- or above in Math 1120, 1130, 1131, 1140, 1148, 1150, or above
Chem 1210	*General Chemistry 1*	5	One unit of high school chemistry, and Math Placement Level L or M; or a grade of C- or above in Math 1120, 1130, 1131, 1148, 1150, or above
Chem 1610	*General Chemistry for Majors 1*	5	One unit of high school chemistry, and Math Placement Level L or M; or a grade of C- or above in Math 1120, 1130, 1131, 1148, or 1150, or above, and enrolled in Chemistry or Biochemistry major; or permission of department

Chem 1910H	*Honors General Chemistry 1*	5	ACT composite score of 30 or above, and ACT mathematics score of 30 or above, and ACT science reasoning score of 28 or above. Prereq or concur: Math 1141 or 1151 or above, or permission of instructor
Chem 1220	*General Chemistry 2*	5	1210, 1215, 1250, 1610, or 1910H, and Math Placement Level L or M, or a grade of C- or above in Math 1120, 1130, 1131, 1148, or 1150, or above; or credit for both Chem 1206 and 1208.
Chem 1620	*General Chemistry for Majors 2*	5	1210, 1215, 1250, 1610, or 1910H; and a grade of C- or above in Math 1120, 1130, 1131, 1148, or 1150, or above, or Math Placement Level L or M; and enrollment in Chemistry or Biochemistry major; or permission of department
Chem 1920H	*Honors General Chemistry 2*	5	1910H (202H). Not open to students with credit for 203H, 1220 or 1620
Required Minor Core Courses			
Bio 3501.04	*Integrative Skills in Biology: Biotechnology*	3	1113, 1114, and Chem 1220; or permission of instructor
Biochem 4820	To Be Developed	3	
EEOB 4840	*Biodiversity Biotechnology*	3	
Micro 4800	*Advances in Microbial Biotechnology*	3	MICRBIO 4100; or BIOCHEM 4511 or 5613; or PHR 3200
MolGen 4810	*Advances in Genetic Biotechnology*	3	MolGen4500 or MolGen4606 with a grade of C- or higher, or permission of instructor
Minor 'Pick 2' Courses			
Biochem 4511	*Introduction to Biological Chemistry*	4	Chem 1220, 1250, 1620, or 1920H, and 2510, 2310, 2610, or 2910H and one semester of Biological Sciences
Biochem 5613	*Biochemistry and Molecular Biology I*	3	Chem 2510 (252), 2610, or 2910H. Prereq or concur: Chem 2520 (253), 2620, or 2920H, and one semester in Biological Sciences
EEOB 3310.01	*Evolution*	4	Biology 1114 or 1114H, or permission of instructor.
EEOB 3310.02	*Evolution (Hybrid Online)*	4	Biology 1114 or 1114H, or permission of instructor.
EEOB 3310.20	*Evolution (Hybrid Lecture)*	3	Biology 1114.01 or 1114H; or permission of instructor
Micro 4000x	*Basic and Practical Microbiology*	4	3 credit hours in Biology

Micro 4100	*General Microbiology*	5	Biology 1113, or 1113H, and Chem 1220.
MolGen 4500x	*General Genetics*	3	Biology 1101, 1113, or 1113H, and 3 additional sem cr hrs in Biological Sciences
MolGen 4606	*Molecular Genetics*	4	Biology 1113 (113), 1113H (115H), 1114 (114), 1114H (116H), or Chem 1210 (121) or equiv, or permission of instructor
Elective Minor Courses			
Micro 4891	*Progress in Biotechnology Seminar*	1	Microbiology 4100; or Biochemistry 4511 or 5613; or Pharmacy 3200
Biochem 5621	*Biochemistry and Molecular Biology Laboratory*	4	A grade of C- or above in 4511 or 5613, or equiv.
Micro 4140	*Molecular Microbiology Laboratory*	3	Prereq or concur: Micrbio 4130
Micro 4145	*Introduction to Industrial Microbiology and Bioprocessing Laboratory*	3	4100, or 4000.01, 4000.02; or permission of instructor
Micro 4150	*Immunobiology Laboratory*	3	4110, or 5122, or permission of the Instructor.
MolGen 5601	*Eukaryotic Molecular Genetics Lab*	3-4	4500 or 4606, or permission of instructor.
MolGen 5602	*Eukaryotic Cell and Developmental Biology Lab*	3-4	4500 or 4606; or permission of instructor.
Biochem 5721	*Physical Biochemistry I*	3	Biology 1113; Math 1152 (153), 1172, 1181H, or 2162 (162); and Physics 1201 (113) or 1251 (133). Prereq or concur: Chem 2520 (253), 2620, or 2920H.
Biochem 5722	*Physical Biochemistry II*	3	5721, or Chem 4200 or 4300.
Chem 5230	*Neurotransmitter Chemistry*	3	2520, 2620, or 2920H, and 2540; or Grad standing; or permission of instructor.
Chem 5240	*Introduction to Protein Modeling*	3	Recommended prereq: Biochem 4511. Prereq: 2310, 2510, 2610, or 2910H; or Grad standing; or permission of instructor.
Chem 5430	*Carbohydrate Chemistry*	3	2520 (253), 2620, or 2920H (253H), or equiv.
EEOB 2511	*Human Anatomy*	4	3 sem cr hrs in Biological Sciences
EEOB 3310.22	*Evolution Laboratory*	1	Prereq or concur: 3310.20
EEOB 3320	*Organismal Diversity*	3	3310
EEOB 3410	*Ecology*	4	Biology 1114 or 1114H, or permission of instructor.

EEOB 3510	*Cellular and Developmental Biology*	3	3310, and Biology 1113 or 1113H
EEOB 3610	*Evolutionary Genomics*	3	none
EEOB 4520	*Comparative Physiology*	4	Biology 1114 or 1114H, and 1 course in Biological Sciences
EEOB 4560	*Comparative Endocrinology*	2	4520 and Biochem 4511, or equiv, or permission of instructor
EEOB 5360	*Biodiversity Informatics*	3	3410, or 3310.01, or 3310.02; or permission of instructor.
Micro 2100	*Wild Yeast: Isolation to Fermentation*	3	Biology 1110 or 1113, and Chem 1110, 1210, or 1610; or permission of instructor.
Micro 4110	*Microbial Pathogenesis and Immunobiology*	3	4000 (509) or 4100 (520)
Micro 4120	*Microbial Physiology and Diversity*	3	4100. Prereq or concur: Biochem 4511.
Micro 4130	*Microbial Genetics*	3	4100, MolGen 4500, or 4606.
Micro 5161	*Introduction to Computational Genomics*	3	none
MolGen 3436	*Introductory Plant Physiology*	3	Biology 1113, 1113H, 1114, 1114H, and 6 cr hrs in Chem.
MolGen 4700	*Molecular, Cell, and Developmental Biology*	3	4500 or 4606, or permission of instructor.
MolGen 4703	*Human Genetics*	3	A grade of C- or above in 4500 or 4606, or permission of instructor.
MolGen 5300	*Cancer Genetics*	3	A grade of C- or above in 4606 or 4500; or Grad standing.
MolGen 5607/5607E	*Cell Biology / Cell Biology with Embedded Honors*	3/4	4500 or 4606.
MolGen 5623	*Genetics and Genomics*	3	4500, 4606, 5607, or 5608, or Grad standing
MolGen 5650	*Analysis and Interpretation of Biological Data*	3	Math 1149 or 1150 (150) or equiv, and 10 semester cr hrs at the 3000-level (or 300 level in the quarter system) or above in Agricultural or Biological Sciences.
MolGen 5701	*DNA Transactions and Gene Regulation*	3	4500, 4606, Biochem 4511, or equiv., and Sr standing; or Grad standing; or permission of instructor. Cross-listed in Biochem.
MolGen 5800	*Organelle Biology*	2	4500, 4500E, or 4606, or permission of instructor
MolGen 5xxx	*Genome Analysis*	3	To Be Developed

Appendix D: Concurrences

College of Engineering

Wednesday, November 5, 2025 at 1:05:35 PM Eastern Standard Time

Subject: Re: Biotech Science Major and Minor Concurrence Request
Date: Friday, October 10, 2025 at 1:01:49 PM Eastern Daylight Time
From: Matyas, Cory
To: Tomasko, David, Andrews, Adam, Quinzon-Bonello, Rosario
CC: Sabel, Jaime, Vankeerbergen, Bernadette
Attachments: image001.png, image002.png, BME Cocur.pdf, CBE Concur.png

Hi Adam,
Engineering has reviewed the materials and obtained concurrence from both the Department of Biomedical Engineering and the Department of Chemical and Biomolecular Engineering. Neither department raised any concerns with the proposals, and both are supportive of the initiative. Emails confirming from each department are attached.

Please let me know if you need anything further from the College of Engineering.

Cory

THE OHIO STATE UNIVERSITY

Corinne Matyas, M.Ed.
Assistant Dean of Curriculum and Assessment
College of Engineering
Hitchcock Hall | 2070 Neil Ave. | Columbus, OH 43210
614-292-2154 | matyas.3@osu.edu

From: Tomasko, David <tomasko.1@osu.edu>
Date: Friday, October 3, 2025 at 11:28 AM
To: Andrews, Adam <andrews.171@osu.edu>, Matyas, Cory <matyas.3@osu.edu>, Quinzon-Bonello, Rosario <quinzon-bonello.1@osu.edu>
Cc: Sabel, Jaime <sabel.12@osu.edu>, Vankeerbergen, Bernadette <vankeerbergen.1@osu.edu>
Subject: Re: Biotech Science Major and Minor Concurrence Request

Hi Adam,
We'll share this with a couple of relevant departments get some feedback.

Cory/Rosie,
I suggest CBE and BME.

David

Friday, October 10, 2025 at 12:55:30 PM Eastern Daylight Time

Subject: RE: Biotech Science Major and Minor Concurrence Request
Date: Friday, October 10, 2025 at 12:33:03 PM Eastern Daylight Time
From: Childers, Rachel
To: Matyas, Cory, Ghadiali, Samir
Attachments: image003.png, image004.png, image005.png

Hi Cory,

I don't see any issues with concurrence for these proposals. The upper level course choices are pretty different from BME and seem to align more heavily on the microbio side of things.

Rachel Childers, Ph.D.

Professional Practice Associate Professor & Director of Undergraduate Education

Department of Biomedical Engineering

Fontana Labs 4100B, 140 W 19th Ave., Columbus, Ohio 43210

Childers.73@osu.edu | 614.247.6681

(She/Her) | Student Hours Link

THE OHIO STATE UNIVERSITY

From: Matyas, Cory <matyas.3@osu.edu>
Sent: Friday, October 3, 2025 1:55 PM
To: Childers, Rachel <childers.73@osu.edu>; Ghadiali, Samir <ghadiali.1@osu.edu>
Subject: FW: Biotech Science Major and Minor Concurrence Request

Hi Rachel & Samir,
The Center for Life Sciences Education has proposed new Major and Minor programs in Biotech Science and is requesting concurrence from the College of Engineering. Given the potential for content overlap, David suggested BME should review the proposals.

If you can, please review the attached documents and share your feedback with me by October 12, so the College has time to prepare our formal response.

Happy Friday!
Cory

THE OHIO STATE UNIVERSITY

Corinne Matyas, M.Ed.
Assistant Dean of Curriculum and Assessment
College of Engineering

Department of Chemical and Biomolecular Engineering

FW: Biotech Science Major and Minor Concurrence Request

Endres, Brian <endres.10@osu.edu>

Today at 1:30 PM

To: Matyas, Cory

Well, this was quick! CBE grants concurrence for the major and minor.

Thanks!
Brian

THE OHIO STATE UNIVERSITY

Brian Endres, M.Ed
Manager, Academic Advising
William G. Lowrie Department of Chemical and Biomolecular Engineering
616 Koffolt Laboratories (CBEC), 151 W. Woodruff Ave., Columbus, OH 43210
endres.10@osu.edu; cbe.osu.edu
SCHEDULE ADVISING APPT
My ZOOM meeting room

College of Food, Agriculture and Environmental Science

Friday, October 24, 2025 at 7:16:55 AM Eastern Daylight Time

Subject: RE: Biotech Science Major and Minor Concurrence Request
Date: Thursday, October 23, 2025 at 9:21:12 AM Eastern Daylight Time
From: Osborne, Jeanne
To: Andrews, Adam
CC: Sabel, Jaime, Vankeerbergen, Bernadette
Attachments: image001.png, image002.png

Dear Adam,

Thank you for the time to gather feedback from the units within the College of Food, Agricultural, and Environmental Sciences. We are pleased to provide concurrence for the proposed new Major and Minor programs in Biotech Science. There was some feedback from a few units for your consideration:

- Plant Pathology – there are potential mycology courses that might be considered for electives in these programs. I would be happy to organize a discussion.
- Food, Agricultural and Biological Engineering – consider FABENG 3500, Biological Engineering as a possible elective in the major; the extensive minor prerequisites might be limiting in terms of students that could pursue this minor. It is assumed that 'MATH 1150 or higher' would include calculus, and perhaps consider that additional MATH taken by engineers (e.g., MATH 1172) could be counted toward the 23 credits or prerequisites?
- Horticulture and Crop Science – consider HCS 5625, Applied Plant Biotechnology be considered as an option for the minor electives (in addition to the current inclusion in the major electives).

We look forward to these offerings and anticipate that the Biotech Science minor might be of interest to students in our programs.

Please let me know if you need additional information or clarification.

Take care,

Jeanne

THE OHIO STATE UNIVERSITY

Jeanne M. Osborne
Assistant Dean for Academic Affairs
College of Food, Agricultural, and Environmental Sciences
100E Agricultural Administration, 2120 Fyffe Rd.
Columbus, OH 43210
Tel: 614-292-1734
Fax: 614-292-1218
e-mail: Osborne.2@osu.edu

Department of Chemistry and Biochemistry

Friday, October 3, 2025 at 10:34:56 AM Eastern Daylight Time

Subject: Re: Biotech Science Major and Minor Concurrence Request
Date: Friday, October 3, 2025 at 10:34:15 AM Eastern Daylight Time
From: Turro, Claudia
To: Andrews, Adam
CC: Jackman, Jane, Sabel, Jaime
Attachments: image001.png

Hi Adam,

You have the concurrences and support from Chemistry and Biochemistry.

Claudia

Claudia Turro
Dr. Melvin L. Morris Professor and Department Chair

From: "Andrews, Adam" <andrews.171@osu.edu>
Date: Friday, October 3, 2025 at 10:20 AM
To: "Turro, Claudia" <turro.1@osu.edu>
Cc: "Jackman, Jane" <jackman.14@osu.edu>, "Sabel, Jaime" <sabel.12@osu.edu>
Subject: Biotech Science Major and Minor Concurrence Request

Claudia,

Yesterday the CLSE Curriculum Committee approved final versions of the *Biotech Science Major* and *Biotech Science Minor* proposals to move forward. I write to ask formally for CBC's concurrence and support for both proposals.

I am requesting your response within the standard two-week timeframe, by October 17. If you have any questions or concerns, or if this presents a problem, please let me know.

Thank you,
Adam

THE OHIO STATE UNIVERSITY
CENTER FOR LIFE SCIENCES EDUCATION

Adam L. Andrews
Assistant Director for Curriculum & Instruction

College of Arts and Sciences | Center for Life Sciences Education

240D Jennings Hall, 1735 Neil Avenue, Columbus, OH 43210
(614) 247-6345 Office / (614) 292-4390 Fax
andrews.171@osu.edu clse.osu.edu

Friday, October 31, 2025 at 3:28:02 PM Eastern Daylight Time

Subject: Fw: biotech sci
Date: Friday, October 31, 2025 at 2:25:28 PM Eastern Daylight Time
From: Sabel, Jaime
To: Andrews, Adam
Attachments: Outlook-2wiqb3ia.png, Outlook-e0hzlvhd.png

THE OHIO STATE UNIVERSITY
CENTER FOR LIFE SCIENCES EDUCATION

Jaime L. Sabel, Ph.D
Director, Center for Life Sciences Education
Associate Professor, Department of Molecular Genetics

Pronouns: she/her / Honorific: Dr.

The Ohio State University
Center for Life Sciences Education
260P Jennings Hall, 1735 Neil Avenue, Columbus, OH 43210
sabel.12@osu.edu / clse.osu.edu / osu.edu

Phone: (614) 688-0262

From: Kubatko, Laura <lkubatko@stat.osu.edu>
Sent: Friday, October 31, 2025 2:03 PM
To: Sabel, Jaime <sabel.12@osu.edu>
Cc: Kubatko, Laura <lkubatko@stat.osu.edu>
Subject: Re: biotech sci

Hi Jaime,

On behalf of EEOB, I am happy to give concurrence for the Biotech Science major.

Thanks,
Laura

Get Outlook for iOS

Thursday, November 6, 2025 at 8:30:36 AM Eastern Standard Time

Subject: Re: Biotech Sci
Date: Wednesday, November 5, 2025 at 3:09:41 PM Eastern Standard Time
From: Sabel, Jaime
To: Fredrick, Kurt
CC: Andrews, Adam
Attachments: Outlook-xvlutbzc.png, Outlook-xwt03hdj.png

Hi Kurt,
The individual courses will be sent to you separately for concurrence, so yes, we are just asking about the overall framework for the major.

Jaime

THE OHIO STATE UNIVERSITY
CENTER FOR LIFE SCIENCES EDUCATION

Jaime L. Sabel, Ph.D
Director, Center for Life Sciences Education
Associate Professor, Department of Molecular Genetics

Pronouns: she/her / Honorific: Dr.

The Ohio State University
Center for Life Sciences Education
260P Jennings Hall, 1735 Neil Avenue, Columbus, OH 43210
sabel.12@osu.edu / clse.osu.edu / osu.edu

Phone: (614) 688-0262

From: Fredrick, Kurt <fredrick.5@osu.edu>
Sent: Wednesday, November 5, 2025 3:04 PM
To: Sabel, Jaime <sabel.12@osu.edu>
Cc: Andrews, Adam <andrews.171@osu.edu>
Subject: Re: Biotech Sci

Hi Jaime,
I guess I do not understand the question. I know there was a meeting about content overlap between M4800 and the MG course but have not seen a revised syllabus for the MG course. Also, there are other upper-level courses (EEOB, CBC) in the works, but I haven't seen either syllabus. These are all proposed courses at this point, though, and the major doesn't depend on all these offerings. I am okay with the framework in general, as long as the

upper-level courses have non-overlapping science content.
Best,
Kurt

From: Sabel, Jaime <sabel.12@osu.edu>
Date: Wednesday, November 5, 2025 at 1:27 PM
To: Fredrick, Kurt <fredrick.5@osu.edu>
Cc: Andrews, Adam <andrews.171@osu.edu>
Subject: Biotech Sci

Hi Kurt,
I'm checking in to see if you would be able to confirm concurrence on the Biotech Science major. We have everything else in place to submit.

Thanks,
Jaime

THE OHIO STATE UNIVERSITY
CENTER FOR LIFE SCIENCES EDUCATION

Jaime L. Sabel, Ph.D
Director, Center for Life Sciences Education
Associate Professor, Department of Molecular Genetics

Pronouns: she/her / Honorific: Dr.

The Ohio State University
Center for Life Sciences Education
260P Jennings Hall, 1735 Neil Avenue, Columbus, OH 43210
sabel.12@osu.edu / clse.osu.edu / osu.edu
Phone: (614) 688-0262

Department of Molecular Genetics

Tuesday, November 4, 2025 at 11:42:39 AM Eastern Standard Time

---

Subject: Re: Biotech Science Major and Minor Concurrence Request
Date: Tuesday, November 4, 2025 at 11:33:07 AM Eastern Standard Time
From: Dobritsa, Anna
To: Andrews, Adam, Cole, Susan
CC: Sabel, Jaime
Attachments: image001.png

Hi Adam,

Molecular Genetics is happy to provide concurrence to the proposals for Biotech Science Major and Minor. Good luck!

Best,
Anna

****

Anna Dobritsa
Associate Professor, Department of Molecular Genetics
and Center for Applied Plant Sciences
The Ohio State University
Aronoff Laboratory, Rm. 570
318 W. 12th Ave, Columbus, OH 43210
(614) 688-2197

From: Andrews, Adam <andrews.171@osu.edu>
Sent: Friday, October 3, 2025 10:22 AM
To: Cole, Susan <cole.354@osu.edu>
Cc: Sabel, Jaime <sabel.12@osu.edu>; Dobritsa, Anna <dobritsa.1@osu.edu>
Subject: Biotech Science Major and Minor Concurrence Request

Susan,

Yesterday the CLSE Curriculum Committee approved final versions of the *Biotech Science Major* and *Biotech Science Minor* proposals to move forward. I write to ask formally for Molecular Genetics' concurrence and support for both proposals.

I am requesting your response within the standard two-week timeframe, by October 17. If you have any questions or concerns, or if this presents a problem, please let me know.

Thank you,
Adam