Bachelor of Science in Molecular, Cellular, and Developmental Biology

Molecular, Cellular, and Developmental Biology

The Molecular, Cellular, and Developmental Biology B.S. and B.A. degrees provide students with a broad understanding of biological systems at the molecular, cellular, and organismal levels. The MCDB degree includes study of genetics, cell biology, developmental biology, cancer biology, and neurobiology. Students have the option of elective courses in these areas for an advanced, in-depth learning experience.

Undergraduate Admission

Admission to KU

All students applying for admission must send high school and college transcripts to the Office of Admissions. Prospective first-year students should be aware that KU has qualified admission requirements that all new first-year students must meet to be admitted. Consult the Office of Admissions (http://admissions.ku.edu/) for application deadlines and specific admission requirements.

Visit the International Support Services (http://www.iss.ku.edu/) for information about international admissions.

Students considering transferring to KU may see how their college-level course work will transfer on the Office of the University Registrar (https://registrar.ku.edu/credittransfer/) website.

First- and Second-Year Preparation

Because biology study requires preparation in other sciences, students should begin meeting major requirements in the first year. It is particularly important to take CHEM 130 and CHEM 135 in the first year and, for several majors, to take CHEM 330, CHEM 331, CHEM 335, and CHEM 336 in the second year. Ideally, most majors should also take BIOL 150 and BIOL 152 during the first year, as well as BIOL 105.

Code	Title	Hours
General Science Requirements		
BIOL 105	Biology Orientation Seminar	1
CHEM 130	General Chemistry I	5
or CHEM 190 & CHEM 191	Foundations of Chemistry I, Honors and Foundations of Chemistry I Laboratory, Honors	
CHEM 135	General Chemistry II	5
or CHEM 195 & CHEM 196	Foundations of Chemistry II, Honors and Foundations of Chemistry II Laboratory, Honors	
CHEM 330	Organic Chemistry I	3
or CHEM 380	Organic Chemistry I, Honors	
CHEM 331	Organic Chemistry I Laboratory	2
CHEM 335	Organic Chemistry II	3
or CHEM 385	Organic Chemistry II, Honors	
MATH 115	Calculus I	3-4
or MATH 125	Calculus I	
or MATH 145	Calculus I, Honors	
BIOL 370	Introduction to Biostatistics	4
Physics Requirement. Choose one of the following:		8-9
PHSX 114 & PHSX 115	College Physics I and College Physics II	
PHSX 211 & PHSX 216 & PHSX 212 & PHSX 236	General Physics I and General Physics I Laboratory and General Physics II and General Physics II Laboratory	

Code	Title	Hours
Molecular, Cellular & Developmental Biology Requirements		
BIOL 150	Principles of Molecular and Cellular Biology	3
or BIOL 151	Principles of Molecular and Cellular Biology, Honors	
BIOL 152	Principles of Organismal Biology	3
or BIOL 153	Principles of Organismal Biology, Honors	
BIOL 154	Introductory Biology Lab for STEM Majors	2
BIOL 350	Principles of Genetics	4
or BIOL 360	Principles of Genetics, Honors	
BIOL 412	Evolutionary Biology	4
BIOL 416	Cell Structure and Function	3
BIOL 417	Biology of Development	3
or BIOL 447	Biology of Development, Honors	
BIOL 435	Introduction to Neurobiology	3
BIOL 600	Introductory Biochemistry, Lectures	3
BIOL 650	Advanced Neurobiology	3
or BIOL 672	Gene Expression	
or BIOL 680	Genomics	
or BIOL 688	The Molecular Biology of Cancer	
Molecular, Cellular & Developmental Biology Electives		
Any Biology courses numbered 400 or higher. No more than 3 hours of BIOL 423: Non-Lab Independent Study and/or BIOL 424: Independent Study (combined) may be used to fulfill the elective requirement.		12
Capstone Course		
Satisfied by completing a BIOL Capstone Course.		3
BIOL 405	Laboratory in Genetics	
BIOL 426	Laboratory in Cell Biology	
Total Hours		**46**

Major Hours & Major GPA

While completing all required courses, majors must also meet each of the following hour and grade-point average minimum standards:

Major Hours
Satisfied by 46 hours of major courses.

Major Hours in Residence
Satisfied by a minimum of 15 hours of KU resident credit in the major.

Major Junior/Senior Hours
Satisfied by a minimum of 38 hours from junior/senior courses (300+) in the major.

Major Junior/Senior Graduation GPA
Satisfied by a minimum of a 2.0 KU GPA in junior/senior courses (300+) in the major. GPA calculations include all junior/senior courses in the

field of study including F's and repeated courses. See the Semester/Cumulative GPA Calculator (https://sis.ku.edu/gpa-calculator/).

Below is a sample 4-year plan for students pursuing the BS in Molecular, Cellular, and Developmental Biology. To view the list of courses approved to fulfill Core 34, please visit the KU Core 34 page (https://catalog.ku.edu/core34/).

This degree plan assumes students will have the equivalent of MATH 101 or MATH 104 prior to the freshman year, fall semester.

Freshman

Fall	Hours	Spring	Hours
BIOL 150 or 152 (Major Requirement)[2]	3	BIOL 152 or 150 (Major Requirement)[2]	3
CHEM 130 (Core 34: Natural and Physical Sciences (SGE))[040***, 1]	5	BIOL 154 (General Science Requirement)	2
BIOL 105 (General Science Requirement)[9]	1	CHEM 135 (General Science Requirement)	5
Core 34: English (SGE)[010]	3	MATH 115 or 125 (Core 34: Math and Statistics (SGE))[030*, 1]	3-4
Core 34: Communications (SGE)[020]	3	Core 34: English (SGE)[010]	3
	15		**16-17**

Sophomore

Fall	Hours	Spring	Hours
CHEM 330 (General Science Requirement)[4]	3	BIOL 412 (Major Requirement)[3]	4
CHEM 331 (General Science Requirement)	2	BIOL 416 (Major Requirement)[5]	3
BIOL 350 or 360 (Major Requirement)	4	CHEM 335 (General Science Requirement)[3,4]	3
BIOL 370 (General Science Requirement)	4	Core 34: Social and Behavioral Science (SGE)[050]	3
Core 34: Arts and Humanities (SGE)[060]	3	Core 34: US Culture (SGE)[070]	3
	16		**16**

Junior

Fall	Hours	Spring	Hours
BIOL 435 (Major Requirement)[5]	3	PHSX 115 (or PHSX 212 & 236 (General Science Requirement))	4
BIOL 600 (Major Requirement)	3	BIOL 417 (Major Requirement)[3]	3
PHSX 114 (or PHSX 211 & 216, General Science Requirement))	4	BIOL Elective 400+ (Major Requirement)[7]	3
Core 34: Global Culture (SGE)[070]	3	Core 34: Arts and Humanities (SGE)[060]	3
		Core 34: Social and Behavioral Science (SGE)[050]	3
	13		**16**

Senior

Fall	Hours	Spring	Hours
BIOL 405 or 426 (Major Requirement; Capstone)[6]	3	BIOL 650, 672, 680, or 688 (Major Requirement)[8]	3
BIOL Elective 400+ (Major Requirement)[7]	3	BIOL Elective 400+ (Major Requirement)[7]	3
BIOL Elective 400+ (Major Requirement)[7]	3	Second Area of Study/ Elective/Degree/Junior-Senior Hours[10]	3
Second Area of Study/ Elective/Degree/Junior-Senior Hours[10]	3	Second Area of Study/ Elective/Degree/Junior-Senior Hours[10]	3
Second Area of Study/ Elective/Degree/Junior-Senior Hours[10]	3	Second Area of Study/ Elective/Degree/Junior-Senior Hours[10]	1
	15		**13**

Total Hours 120-121

1 MATH 115 and CHEM 130 require MATH ACT scores of 26+, a comparable SAT or KU Math Placement Exam score, or credit for a MATH 101 or MATH 104 equivalent course. MATH 125 requires MATH ACT score of 28+, comparable SAT or KU Math Placement Exam score, or credit in MATH 104.

2 Concurrent or prior enrollment in CHEM 130 is required. BIOL 151 is the honors equivalent of BIOL 150 and offered in the fall semesters. BIOL 153 is the honors equivalent of BIOL 152 and offered in the spring semesters.

3 BIOL 412, BIOL 417, BIOL 426, BIOL 650, and BIOL 672 are offered only in the spring.

4 Most medical schools require CHEM 330, CHEM 331, and CHEM 335.

5 BIOL 405, BIOL 435 and BIOL 688 are offered only in the fall.

6 Choose BIOL 405 or BIOL 426. BIOL 405 is offered only in the fall, and BIOL 426 is offered only in the spring.

7 12 credit hours of BIOL courses at 400+ level, with no more than 3 hours of BIOL 423 and/or BIOL 424 (combined) applied toward the elective requirement.

8 Choose BIOL 650, BIOL 672, BIOL 680, or BIOL 688. BIOL 650 and BIOL 672 are offered only in the spring. BIOL 688 is offered only in the fall. BIOL 680 offering varies.

9 BIOL 105 Biology Orientation Seminar (1 hour online course) is required for the major. It can be taken the summer prior to your freshman year.

10 Hour requirements (incl. 45 jr/sr hrs) are typically met through Core 34, degree, major, second area of study and/or elective hours. Students completing the BGS with a major must choose a secondary area of study. Individual degree mapping is done in partnership with your advisor.

Please note:

Students may earn degrees in more than one major within biological sciences, or in a biological science and an area outside biology by meeting the requirements of both degree programs and taking at least 15 hours of courses unique to each major.

All students in the College of Liberal Arts and Sciences are required to complete 120 total hours of which 45 hours must be at the Jr/Sr (300+) level.

*Courses with a * designate courses that are degree requirements but can also be taken to fulfill the KU Core 34 requirement. If another course if used to fulfill the Core 34 requirement, the course listed is still required as a degree requirement.

Notes:

* - This course is a Required major course and is also part of Core 34: Systemwide General Education. If this course is not taken to fulfill the Core 34:SGE requirement, it must be taken in place of elective hours.

** - This course is a Recommended Core 34: Systemwide General Education course. This specific course is not required but is recommended by the program's faculty.

*** - This course is a Required Core 34: Systemwide General Education course. This program is approved by the Kansas Board of Regents to require this specific Core 34:Systemwide General Education course. If a student did not take this course it must be taken in addition to other degree requirements.

At the completion of this program, students will be able to:

- Explain the sources of genetic variation within populations, how variation is maintained or lost in populations and mechanisms of evolutionary change operating in populations and how these may lead to the formation of biological species. Use the principles of evolution to explain the diversity of life on Earth; describe evidence that supports the conclusion that evolution explains the diversity of life on Earth.
- Describe how organisms inherit genetic information that influences the location, timing, and intensity of gene expression. Explain that cells/organs/organisms have multiple mechanisms to perceive and respond to changing environmental conditions.
- Describe how complex networks are formed by interactions at many biological scales (i.e., molecules, genes, cells, tissues, organs, individuals and ecosystems), and that organisms integrate internal and external information to respond to environmental changes.
- Explain that biological structures exist at all levels of organization, from molecules to ecosystems, and the physical and chemical characteristics of a structure influence its function.
- Apply the scientific method and communicate scientific arguments, ideas, and results clearly and explicitly through writing and speech. Demonstrate a knowledge of the ethical considerations related to scientific research.
- Apply quantitative reasoning, mathematical, statistical, and/or informatics tools to explain, evaluate, and effectively interpret claims, theories, and assumptions in the biological sciences.

Departmental Honors

Undergraduate majors are eligible to graduate with honors in biology if they fulfill the following requirements:

1. Complete all course work required for the appropriate degree in biology.
2. Achieve a minimum grade-point average of 3.5 in the major.
3. Complete BIOL 499 Introduction to Honors Research with a grade of B or higher, or complete two credits total of BIOL 423 and/or BIOL 424 with a grade of B or higher
4. Complete BIOL 699 Biology Honors Research Colloquium with a grade of B or higher.
5. Complete an independent research project under the supervision of a faculty member in an area appropriate to the degree sought.
6. Submit an honors thesis to the honors committee once the research is complete and present the results of the completed research at the honors research symposium.

Specific guidelines and intent forms are available in the Undergraduate Biology Program office and online (http://www.kuub.ku.edu/). Candidates must declare their intent to graduate with honors at least 2 semesters before graduation.

Study Abroad

Consult an advisor at least 4 months before undertaking study abroad. Consult the Office of Study Abroad (http://www.studyabroad.ku.edu/), 108 Lippincott Hall, for information about study in one of the many countries (e.g., Scotland, Australia, Switzerland) with special arrangements with KU.