MOLECULAR AND CELLULAR BIOLOGY + DATA SCIENCE, BSLAS

for the degree of Bachelor of Science Major in Molecular and Cellular Biology + Data Science

In the Molecular and Cellular Biology (MCB) + Data Science (DS) degree program students are provided with a thorough foundation in both molecular and cellular biology and data science through an integrated and deliberate effort to ensure that our students have the necessary understanding of the biological science underpinning the study of life and biological systems, while also having access to the tools and training in the skillsets needed to collect, handle, and interpret the large biological datasets being generated by the field. Thorough preparation in molecular biology, molecular genetics, microbiology, cellular biology, biochemistry, physiology, and structural biology comes from coursework, laboratory classes, as well as research and discovery experiences.
This degree program equips students with the knowledge, tools, and skills to manage and analyze very large and diverse datasets across various biological systems, including healthcare systems, pharmaceutical industry, biologically and environmentally relevant government agencies, and data-intensive biological research areas.

Undergraduate degree programs in Molecular & Cellular Biology

- Biochemistry, BS
- Molecular & Cellular Biology, BSLAS
- Molecular & Cellular Biology Honors Concentration, BSLAS
- Molecular & Cellular Biology + Data Science, BSLAS
- Neuroscience, BSLAS

Distinction

Students in MCB + Data Science can qualify for Distinction via one of the following:
Distinction for Excellence in Research:
To be eligible for graduation with Distinction a student must:
Complete 3 semesters of MCB 290 for 2 credit hours or more each semester. Maintain a minimum cumulative GPA of 3.25 at the end of penultimate semester. Give at least one poster presentation at the Undergraduate Research symposium or other approved venue. Obtain a letter of support from their Principal Investigator.

To be eligible for graduation with High Distinction a student must:

- Complete 2 semesters of MCB 290 for 2 credit hours or more each semester.
- Complete 1 semester of MCB 492 for 3 credit hours or more. Maintain a minimum cumulative GPA of 3.25 at the end of penultimate semester.
- Give at least one poster presentation at the Undergraduate Research symposium or other approved venue.
- Obtain a letter of support from their Principal Investigator.
- Submit a written thesis that is approved by the Distinction Committee.

To be eligible for graduation with Highest Distinction a student must:

- Complete 2 semesters of MCB 290 for 2 credit hours or more each semester.
- Complete 1 semester MCB 492 for 3 credit hours or more. Maintain a minimum cumulative GPA of 3.90 at the end of penultimate semester.
- Give at least one poster presentation at the Undergraduate Research symposium or other approved venue.
- Obtain a letter of support from their Principal Investigator.
- Submit a written thesis that is approved by the Distinction Committee.

To be eligible for graduation with Academic Distinction a student must:

- Maintain a major GPA of 3.90 or higher in the MCB + Data Science major (biology, chemistry, and math courses for the MCB + Data Science major) at the end of their penultimate semester.

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Graduation Requirements

Minimum hours required for graduation: 120 hours.

University Requirements

Minimum of 40 hours of upper-division coursework, generally at the 300- or 400-level. These hours can be drawn from all elements of the degree. Students should consult their academic advisor for additional guidance in fulfilling this requirement.

The university and residency requirements can be found in the Student Code (https://studentcode.illinois.edu/article3/part8/3-801/) (§ 3-801) and in the Academic Catalog (http://catalog.illinois.edu/general-information/degree-general-education-requirements/).

General Education Requirements

Follows the campus General Education (Gen Ed) requirements (https://courses.illinois.edu/gened/DEFAULT/DEFAULT/). Some Gen Ed requirements may be met by courses required and/or electives in the program.

Code	Title	Hours
Composition I		4-6
Advanced Composition		3
Humanities & the Arts (6 hours)		6
Natural Sciences & Technology (6 hours)		6
	fulfilled by MCB 150, CHEM 102, CHEM 104	
Social & Behavioral Sciences (6 hours)		6
Cultural Studies: Non-Western Cultures (1 course)		3
Cultural Studies: US Minority Cultures (1 course)		3
Cultural Studies: Western/Comparative Cultures (1 course)		3
Quantitative Reasoning (2 courses, at least one course must be Quantitative Reasoning I)		6-10

fulfilled by MATH 220 or MATH 221; STAT 107, STAT 207

Language Requirement (Completion of the fourth semester or equivalent of a language other than English is required)	0-20

Code	Title	Hours
Orientation and Professional Development		
LAS 101	Design Your First Year Experience	1
OR		
LAS 100 & LAS 101	Success in LAS for International Students and Design Your First Year Experience	3
OR		
LAS 102	Transfer Advantage	1
Total Hours		**1 or 3**

Code	Title	Hours
Major Core Requirements and Electives		
MCB Core		**17**
MCB 150	Molecular & Cellular Basis of Life	
MCB 250	Molecular Genetics	
MCB 251	Exp Techniqs in Molecular Biol	
MCB 252	Cells, Tissues & Development	
MCB 253	Exp Techniqs in Cellular Biol	
MCB 354	Biochem & Phys Basis of Life	
Data Science Core		**29-30**
Mathematical Foundations		
MATH 220	Calculus	
or MATH 221	Calculus I	
MATH 227	Linear Algebra for Data Science	
or MATH 257	Linear Algebra with Computational Applications	
Data Science Fundamentals		
STAT 107	Data Science Discovery	
STAT 207	Data Science Exploration	
CS 307	Modeling and Learning in Data Science	
Computational Fundamentals		
CS 277	Algorithms and Data Structures for Data Science	
Social Impact in Data Science		
IS 467	Ethics and Policy for Data Science	
IS 477	Data Management, Curation & Reproducibility	
Chemistry		**10**
CHEM 102	General Chemistry I	
CHEM 104	General Chemistry II	
CHEM 232	Elementary Organic Chemistry I	
Advanced MCB Lab Courses		**2-4**
At least one course from this list is required.		
MCB 301	Experimental Microbiology	
MCB 364	Eukaryotic Cell Biology Laboratory	
MCB 428	Microbial Pathogens Laboratory	
MCB 460	Neuroanatomy Laboratory	
BIOC 455	Technqs Biochem & Biotech	
Advanced Courses Group A		**9**
At least 3 courses, a minimum of 9 credit hours, is required from this list.		
MCB 317	Genetics and Genomics	
MCB 419	Brain, Behavior & Info Process	
MCB 421	Microbial Genetics	
MCB 432	Computing in Molecular Biology	
MCB 435	Evolution of Infectious Disease	
BIOC 446	Physical Biochemistry	
BIOP 401	Introduction to Biophysics	
Advanced Courses Group B		**9**
At least 3 courses, a minimum of 9 credit hours, is required from this list.		
MCB 300	Microbiology	
MCB 314	Introduction to Neurobiology	
MCB 316	Genetics and Disease	
MCB 320	Mechanisms of Human Disease	
MCB 400	Cancer Cell Biology	
MCB 401	Cellular Physiology	
MCB 402	Sys & Integrative Physiology	
MCB 406	Gene Expression & Regulation	
MCB 408	Immunology	
MCB 410	Developmental Biology, Stem Cells and Regenerative Medicine	
MCB 413	Endocrinology	
MCB 424	Microbial Biochemistry	
MCB 426	Bacterial Pathogenesis	
MCB 430	Molecular Microbiology	
Research or Discovery Experience		**6**
One of the most important skills a student will gain in the MCB + DS degree will be the ability to work with data in context. A minimum of 6 credit hours of research or discovery experience is required. This can be achieved through one or more of the options listed below.		
Option 1		
MCB 290	Undergraduate Research	
Completed in School of MCB research labs, designated MCB data science-focused labs is encouraged. Optional: MCB 492: Senior Thesis in MCB 290 research lab.		
Option 2		
MCB 292	Experiential Learning in MCB	
Option 3		
School of MCB-developed Study Abroad Program where advanced courses in MCB and Data Science are the focus (minimum of the equivalent to 6 UIUC credit hours transferred back to Illinois). Some programs offer course-based research experiences in MCB research laboratories with an emphasis on Data Science. Students choose from MCB-developed residential study abroad programs. All courses are selected under the supervision of an MCB Study Abroad Academic Advisor and will be pre-articulated.		

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Upon successful completion of the Molecular & Cellular Biology + Data Science undergraduate curriculum, students will be able to:

1. Understand and appreciate the diversity of life as it evolved over time by processes of mutation, selection, and genetic change.
2. Illustrate that fundamental structural units define the function of all living things.
3. Explain that the growth, development, and behavior of organisms are activated through the expression of genetic information in context.
4. Summarize that biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of physics.
5. Illustrate that living systems are interconnected and interacting across scales of space and time.
6. Design a scientific process and employ the scientific method, demonstrating that biology is evidence based and grounded in the formal practices of observation, experimentation, and hypothesis testing.
7. Apply critical thinking and quantitative reasoning skills to solve problems.
8. Execute quantitative analysis to interpret biological data.
9. Construct and utilize predictive models to study and describe complex biological systems.
10. Apply concepts from other sciences in order to interpret biological phenomena.
11. Communicate biological concepts and understanding to members of a diverse scientific community as well as to the general public.
12. Identify social and historical dimensions of biological investigation.
13. Develop relevant programming abilities.
14. Demonstrate proficiency with statistical analysis of data.
15. Develop the ability to build and assess data-based models.
16. Execute statistical analyses with professional statistical software.
17. Demonstrate skill in data management.
18. Apply data science concepts and methods to solve problems in real-world contexts and communicate these solutions effectively.

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This sample sequence is intended to be used only as a guide for degree completion. All students should work individually with their academic advisors to decide the actual course selection and sequence that works best for them based on their academic preparation and goals. Enrichment programming such as study abroad, minors, internships, and so on may impact the structure of this four-year plan. Course availability is not guaranteed during the semester indicated in the sample sequence.

Students must fulfill their Language Other Than English requirement by successfully completing a fourth level of a language other than English. For more information, see the corresponding section on the Degree and General Education Requirements page *(*http://catalog.illinois.edu/general-information/degree-general-education-requirements/*).*

First Year

First Semester	Hours	Second Semester	Hours
LAS 101	1	MATH 227 or 257	3
MCB 150 (or Composition I)	4	Composition I or MCB 150	4
MATH 220 or 221	4	CHEM 104	3
STAT 107	4	General Education Course	3
CHEM 102	3	Free Elective Course	1
	16		**14**

Second Year

First Semester	Hours	Second Semester	Hours
MCB 250	3	MCB 252	3
MCB 251	2	MCB 253	2
CHEM 232	4	CS 277	4
STAT 207	4	General Education Course	3
Language Other Than English (3rd level)	4	Language Other Than English (4th level)	4
	17		**16**

Third Year

First Semester	Hours	Second Semester	Hours
MCB 354	3	Advanced Group B course	3
Advanced Group A Course	3	Advanced MCB Lab	2
CS 307	4	Research or Discovery Experience	2
General Education Course	3	General Education Course	3
General Education Course	3	General Education Course	3
	16		**13**

Fourth Year

First Semester	Hours	Second Semester	Hours
Advanced Group A Course	3	Advanced Group A Course	3
Advanced Group B Course	3	Advanced Group B Course	3
IS 467	3	IS 477	3
Research or Discovery Experience	2	Reasearch or Discovery Experience	2
General Education Course	3	General Education Course	3
	14		**14**

Total Hours 120

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School of Molecular & Cellular Biology website (https://mcb.illinois.edu/undergrad/)
School Faculty (https://mcb.illinois.edu/people/)

MCB advising (https://mcb.illinois.edu/academics/undergraduate-programs/school-mcb-center-advising/)

MCB advising email (advising@mcb.illinois.edu)

Overview of College Admissions & Requirements: Liberal Arts & Sciences (http://catalog.illinois.edu/schools/las/academic-units/)
College of Liberal Arts and Sciences website (https://las.illinois.edu/)