PURDUE UNIVERSITY

Cell, Molecular, and Developmental Biology (CMDB)

College of Science

2023-2024

Program Progression Guides

Disclaimer: The 2023-24 Purdue West Lafayette catalog is considered the source for academic and programmatic requirements for students entering programs during the Fall 2023, Spring 2024, and Summer 2024 semesters. The Program Progression Guide assists students in the development of an individualized 8-semester plan. Students are encouraged to use this guide, MyPurduePlan* (online degree auditing tool) and the Student Educational Planner (SEP) as they work with their academic advisor towards the completion of their degree requirements.

Notification: Each student is ultimately responsible for knowing, monitoring and completing all degree requirements.

An undergraduate degree in the College of Science requires completion of the following degree requirements.

<table>
<tr><th colspan="3">University Degree Requirements</th></tr>
<tr><td>Minimum 2.0 Cumulative GPA</td><td>Minimum 120 Credits that fulfill degree requirements</td><td>32 Residency Credits (30000-level and above) at a Purdue University campus</td></tr>
<tr><th colspan="3">University Core Curriculum**
https://www.purdue.edu/provost/students/s-initiatives/curriculum/courses.html</th></tr>
<tr><td colspan="2">• Human Cultures: Behavioral/Social Science
• Human Cultures: Humanities
• Information Literacy
• Oral Communication</td><td>• Quantitative Reasoning
• Science
• Science, Technology & Society Selective
• Written Communication</td></tr>
<tr><th colspan="3">Civic Literacy Proficiency
https://www.purdue.edu/provost/about/provostInitiatives/civics/</th></tr>
<tr><td colspan="3"></td></tr>
<tr><th colspan="3">Required Major Program Courses (see following pages)</th></tr>
<tr><td colspan="3">Departmental specific requirements, including 2.0 average GPA in classes required to fulfill biology requirements.
Minimum 2.0 cumulative GPA
Must have a 500-level BIOL course (2-3 credit approved BIOL lecture)</td></tr>
<tr><th colspan="3">College of Science Core Curriculum
https://www.purdue.edu/science/Current_Students/curriculum_and_degree_requirements/college-of-science-core-requirements.html?</th></tr>
<tr><td>• Freshman Composition – 3 credits
• Technical Writing and Presentation - 3 credits
• Teaming & Collaboration (NC)
• General Education - 9 credits</td><td>• Foreign Language & Culture – 9 credits
• Great Issues - 3 credits
• Laboratory Science - 8 credits
• STS (Science, Tech & Society) - 3 credits</td><td>• Mathematics - 6-10 credits
• Statistics - 3 credits
• Computing - 3 credits</td></tr>
<tr><th colspan="3">Degree Electives</th></tr>
<tr><td colspan="3">Any Purdue or transfer course approved to meet degree requirements in accordance with individual departmental policies. Consult the No Count Course List for courses which may not be used to meet any College of Science degree requirement.</td></tr>
</table>

* This audit is not your academic transcript and it is not official notification of completion of degree or certificate requirements.

** University Core Curriculum Outcomes may be met through completion of the College of Science Core curriculum. Students should consult with their academic advisors and MyPurdue Plan for course selections.

2023-24 Cell, Molecular, and Developmental Biology
Degree Progression Guide

The Department of Biological Sciences has suggested the following degree progression guide for the Cell, Molecular, and Developmental Biology Degree. Students will work with their academic advisors to determine their best path to degree completion. Course pre-requisite notes are specific to this degree plan (not all pre-requisites are listed for every course).

Credit	Fall 1st Year	Prerequisite	Credit	Spring 2nd Year	Prerequisite
2	BIOL 12100		3	BIOL 13100	
5	CHM 12901	ALEKS 85 or Calc Placement	4	CHM 25500 - 25501	CHM 12901
2	BIOL 13500 or 19500	CHM 12901 co-req	3-5	Calculus II selective	Calc I (with min grade C-)
3-5	Calculus I selective	ALEKS 75 or 85	3-4	Science Core Option	
3	Science Core Option		3	Science Core Option	
1	Elective (BIOL 11500 pref.)	BIOL 12100 co-req			
16-18			**16-19**		

Credit	Fall 2nd Year	Prerequisite	Credit	Spring 2nd Year	Prerequisite
3	BIOL 23100	BIOL 13100 and co-req CHM 12901	3	BIOL 24100	BIOL 23100
2	BIOL 23200	Co-req BIOL 23100	2	BIOL 24200	
4	CHM 25600 and CHM 25601	CHM 25500	3	CHM 33900	C- or better in all prior CHM courses
3	Science Core Option		1	CHM 33901	CHM 33900 co-req
3	Science Core Option		2	BIOL 28600	BIOL 12100
			1	Free Elective (BIOL 29300 pref)	
			3	Science Core Option	
15			**15**		

Credit	Fall 3rd Year	Prerequisite	Credit	Spring 3rd Year	Prerequisite
3	Intermediate Biology Selective	BIOL 23100 and 24100	3	Cell/Molecular/Develop Selective I	BIOL 23100 and 24100
4	PHYS I Selective		4	PHYS II Selective	
3	Elective		3-4	Science Core Option	
3	Science Core Option		3	Science Core Option	
3	Elective		1	Elective	
			1	Elective (BIOL 39300 pref)	
16			**15-17**		

Credit	Fall 4th Year	Prerequisite	Credit	Spring 4th Year	Prerequisite
3	Cell/Molecular/Develop Selective I		3	Cell/Molecular/Develop Selective II	
2-4	Base Lab Requirement		3	Biology Selective	
3	Science Core Option		3	Science Core Option	
1-3	Science Core Option		3	Elective	
3	Elective		3	Elective	
12-16			**15**		

Science Core Curriculum Options

(one course needed for each requirement unless otherwise noted)

Options recommended for first- and second-year students	Options recommended for third- and fourth-year students
Freshman Composition[UC]	Technical Writing and Presentation[UC] (COM 217 recommended)
General Education[UC] (3 courses needed)	Statistics (STAT 50300)
Foreign Language and Culture[UC] (3 courses needed)	Computing (CS 17700 or CS 18000 also meet Teambuilding)
STS[UC] (BIOL 12100)	Great Issues

[UC] Select courses may also satisfy a University Core Curriculum requirement; see the University Core Requirement course list for approved courses. Students must have 32 credits at the 30000 level or above taken at Purdue.

CELL, MOLECULAR AND DEVELOPMENTAL BIOLOGY (CMDB)

Fall 2023

Graduation Requirements:

- *A minimum 2.0 average in all biology courses required for this major.*
- *At least one approved 2-3 credit **500-level Biology** course is required (excludes lab only courses such as BIOL 54200 & 5xxxx lab modules)*
- *A minimum of 32 credits at or above the 300-level completed at a Purdue campus*
- *120 Total Credits Minimum*

BIOLOGY CORE (19 credits):

1. BIOL 12100 Biology I: Diversity, Ecology and Behavior (2 cr.; fall)
2. BIOL 13100 Biology II: Development, Structure, and Function of Organisms (3 cr.; spring)
3. BIOL 13500 1st Year Biology Lab (2 cr.; both) **or**
   BIOL 19500 Year I Bio Lab: Diet, Disease & the Immune System (2 cr.; spring) **or**
   BIOL 19500 Year I Bio Lab: Disease Ecology (2 cr.; alternate fall) **or**
   BIOL 19500 Year I Bio Lab: Phages to Folds (2 cr.; fall)
4. BIOL 23100 Biology III: Cell Structure and Function (3 cr.; fall)
5. BIOL 23200 Laboratory in Biology III: Cell Structure and Function (2 cr.; fall)
6. BIOL 24100 Biology IV: Genetics and Molecular Biology (3 cr.; spring)
7. BIOL 24200 Laboratory in Genetics and Molecular Biology (2 cr.; spring)
8. BIOL 28600 Intro. to Ecology & Evolution (2 cr.; spring)

UPPER-LEVEL BIOLOGY COURSEWORK (13-19 credits)[1]:

Course(s) taken for #9, #10, #11 and/or #12 must NOT overlap (i.e., a course can *only* be used to meet either the Intermediate Biology Selective *or* CMDB Selectives I *or* CMDB Selectives II, *or* the Biology Selectives requirement).

9. **Intermediate Biology Selective**: complete *ONE* course:
   (CMDB majors must take BIOL 41500 or 42000 for this requirement)
   - A. BIOL 32800 Principles of Physiology (4 cr.; spring)
   - B. BIOL 36700[1] Principles of Development (2 cr.; fall)
   - C. BIOL 39500 Macromolecules (2 cr.; fall)
   - D. **BIOL 41500**[1] **Intro. to Molecular Biology** (3 cr.; spring)
   - E. BIOL 41600 Viruses & Viral Diseases (3 cr.; spring)
   - **F. BIOL 42000**[1] **Eukaryotic Cell Biology** (3 cr.; fall)
   - G. BIOL 43600 Neurobiology (3 cr.; fall)
   - H. BIOL 43800 General Microbiology (3 cr.; fall)

10. **CMDB Selectives I**: complete *TWO* courses:
    - A. BIOL 36700[1] Principles of Development (2 cr; fall)
    - B. BIOL 41500[1] Intro. to Molecular Biology (3 cr; spring)
    - C. BIOL 42000[1] Eukaryotic Cell Biology (3 cr.; fall)
    - D. BIOL 48100[1] Eukaryotic Genetics (3 cr.; spring)

11. **CMDB Selective II**: complete *ONE* of these courses (also meets the 500-level BIOL requirement):
    - A. BIOL 51600[1] Molecular Biology of Cancer (3 cr. spring)
    - B. BIOL 59500[1] CRISPR Mechanisms & Applic (3 cr. spring)
    - C. BIOL 59500[1] Cell Biology of Plants (3 cr.; alt fall)
    - D. BIOL 59500[1] Pathways in Hum Health & Disease (3 cr; fall)
    - E. BIOL 59500[1] Theory of Molecular Methods (3 cr.; spring)

12. **Biology Selectives**: complete *ONE* course from the following:

BIOL 39500	Macromolecules (2 cr.; fall)	BIOL 56310	Protein Bioinformatics (2 cr.; alt spring)
BIOL 39500[3]	Experimental Design & Quantitative Analysis (3 cr.; summer)	BIOL 58000	Evolution (3 cr.; spring)
BIOL 41600	Viruses and Viral Diseases (3 cr.; spring)	BIOL 58210[3]	Ecological Statistics (3 cr.; fall)
BIOL 43600	Neurobiology (3 cr.; fall)	BIOL 58705	Animal Communication (3 cr.; alt fall)
BIOL 43800	General Microbiology (3 cr.; fall)	BIOL 59200	Evolution of Behavior (3 cr.; spring)
BIOL 44400	Human Medical Genetics (3 cr.; spring)	BIOL 59500[3]	Building the Tree of Life (3 cr.; spring)
BIOL 47800	Intro to Bioinformatics (3 cr.; fall)	BIOL 59500[1]	Cell Biology of Plants (3 cr.; fall)
BIOL 48100[1]	Eukaryotic Genetics (3 cr.; spring)	BIOL 59500[1]	CRISPR Mechanisms & Applications (3 cr,; spring)
BIOL 48300[2,3]	Environmental & Conservation Biology (3 cr.; alt spring)	BIOL 59500[3]	CryoEM 3D Reconstruction (3 cr.; fall)
BIOL 49500[3]	Biodiversity & Museum Research (3 cr.; fall)	BIOL 59500	Disease Ecology (3 cr.; spring)
BIOL 49500[3]	Data Science for Biologists (3 cr.; fall)	BIOL 59500	Ecology (3 cr.; fall)
BIOL 49500[3]	Topics in Endocrinology & Cancer (2 cr.; spring)	BIOL 59500	Immunology of Cancer & Infectious Dis (2 cr.; spring)
BIOL 49500	The RNA World, CRISPR & Coronavirus (3 cr; spring)	BIOL 59500	Methods & Measurmt in Physical Biochem (3 cr.; fall)
BIOL 51600[1]	Molecular Biology of Cancer (3 cr.; spring)	BIOL 59500	Neurobiology of Learning & Memory (3 cr.; alt. fall)
BIOL 51700	Molecular Biology: Proteins (2 cr.; alt spring)	BIOL 59500[1]	Pathways in Human Health & Disease (3 cr.; fall)
BIOL 53300	Medical Microbiology (3 cr.; fall)	BIOL 59500	Practical BioComputing (3 cr.; spring)
BIOL 53601	Biological & Structural Aspects of Drug Design & Action (3 cr; spr)	BIOL 59500[1,3]	Theory of Molecular Methods (3 cr.; spring)
BIOL 53700	Immunobiology (3 cr.; fall)	BIOL 59500	X-Ray Crystallography (3 cr.; spring)
BIOL 53800	Molec, Cellular & Develop Neuro (3 cr.; spring)	BCHM 43400	Medical Topics in Biochemistry (3 cr.; spring)
BIOL 56200	Neural Systems (3 cr.; spring)	BCHM 52100	Comparative Genomics (3 cr.; spring)

13. **Base Lab Requirement:** see "Base Lab Requirement (BLR) for all Biology Majors" as described on the next page

NOTE: Footnotes are included on the last page.

Base Laboratory Requirement (BLR) for all Biology Majors

1. Each student must complete one course from the "Required Course" list in the chart below. Undergraduate research cannot be used to meet this requirement.
2. Students must also satisfy Objectives A and B as listed in the chart below, which can be met by courses, research, or a combination of the two.
3. Descriptions of Objectives A and B (not all tasks must be met to satisfy an objective):
    a. **Objective A** – Demonstrate the ability to plan and design hypothesis-driven experiments, simulations or discovery/observational experiments.
        i. Conduct an appropriate literature review for a specific scientific topic.
        ii. Generate an applicable hypothesis (-es) for your research project.
        iii. Identify techniques to be used in your project, with justification of those techniques.
        iv. Write a formal research proposal.
        v. Write a detailed outline of experiments.
    b. **Objective B** - Develop the ability to appropriately analyze, critically evaluate, and depict data. Demonstrate the ability to effectively communicate scientific information orally and in writing, including synthesizing and evaluating scientific literature and putting experimental results in their appropriate scientific context.
        i. Analyze data.
        ii. Use appropriate ways to depict and communicate data (e.g., graphs, movies, images, etc.). Present the research at lab meetings, in a talk, or at a poster session.
        iii. Write a summary (or summaries) of the data.
4. If research is used, the research director will be the one who decides if the research meets Obj A and/or Obj B.
5. If research is used, it must include at least four credits of BIOL 49400 and/or 49900. (BIOL 29400, non-BIOL research, and research for pay will not count toward the BLR.)
6. Students who successfully complete a Biology Honors Research Thesis automatically meet Objectives A and B with the approved thesis but must still complete a "Required Course."
7. The *"Microbiology"* and the *"Health & Disease"* majors must use BIOL 43900 Micro Lab for the BLR; the *"Ecology, Evolution and Environmental Biology"* majors must use BIOL 59500 Laboratory in Ecology for the BLR.

Base Laboratory Requirement Chart

Course	Title	Required Course	Obj. A	Obj. B	Usually Offered	Format	Pre-Req (PR) or Co-Req (CR) *beyond* core courses
BIOL 32800	Principles of Physiology (4cr)	X			Spring		
BIOL 39500DIST	Exper Design & Quant Analysis (3cr)		X	X	Summer		
BIOL 43900	Microbiology Lab (2cr)	X	X	X	Fall		PR/CR=43800
BIOL 44212	Microscopy & Cell Bio (1cr)	X		X	Spring	5-wk module	
BIOL 48300	Environmental & Conservation Biology (3cr)		X	X	alt Spring '24		
BIOL 49500BMR	Biodiversity & Museum Research (3cr)		X	X	Fall		
BIOL 49500DSB	Data Science for Biologists (3cr)	X	X	X	Fall		PR=28600
BIOL 49500TEC	Topics in Endocrinology & Cancer (2cr)		X	X	Spring		
BIOL 54200	Neurophysiology (1cr)	X		X	Fall	5-wk module	PR=32800 or CR=43600
BIOL 58210	Ecological Statistics (3cr)		X	X	Fall		PR=STAT 50300
BIOL 59100	Field Ecology (4cr)	X	X	X	alt Fall '23		CR/PR=59500EL
BIOL 59500BTL	Building the Tree of Life: Phylogenetics (3cr)	X	X	X	Spring		research experience recommended
BIOL 59500CRYO	CryoEM 3D Reconstruction (3cr)		X	X	Fall		PR=PHYS 23300 or 17200
BIOL 59500BN	Data Analysis in Neuroscience (1cr)			X	Spring	5-wk module	
BIOL 59500EL	Laboratory in Ecology (1cr)	X	X	X	Fall		PR/CR=59500 Ecology
BIOL 59500	Neural Mechanisms in Health & Disease (3cr)		X	X	alt Spring '23		PR=32800 or 43600; CR=56200
BIOL 59500SBL	Structural Biology Lab (1cr)	X		X	Spring	5-wk module	
BIOL 59500TMM	Theory of Molecular Methods (3cr)		X	X	alt Spring		BIOL 415 or other molecular biology

CHEMISTRY (17 credits) -- complete all of the following:

1. General Chemistry (5 credits):
   CHM 12901 General Chemistry with a Biological Focus (5 cr.; fall)

2. Organic Chemistry (8 credits):
   CHM 25500 Organic Chemistry I (3 cr.; both) and
   CHM 25501 Organic Chemistry Lab I (1 cr.; both) and
   CHM 25600 Organic Chemistry II (3 cr.; both) and
   CHM 25601 Organic Chemistry Lab II (1 cr.; both)

3. Biochemistry (4 credits):
   CHM 33900 Biochemistry: A Molecular Approach (3 cr.; spring) and
   CHM 33901 Biochemistry Laboratory (1 cr; spring)

PHYSICS (8 credits) -- One of these two options (PHYS 23300+23400 are recommended):

1. PHYS 23300 Physics for Life Sciences I (4 cr.; both) and
   PHYS 23400 Physics for Life Sciences II (4 cr.; both)

2. PHYS 17200 Modern Mechanics (4 cr.; both) and one of the following two choices:
   A. PHYS 27200 Electric and Magnetic Interactions (4 cr.; both) or
   B. PHYS 24100 Electricity and Optics (3 cr.; both) and PHYS 25200 Electricity and Optics Laboratory (1 cr.; spring)

OTHER: all University Core, College of Science Core, and Civics Literacy Requirements must also be completed.

FREE ELECTIVES Approximately 12-24 credits

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[1] Course(s) taken for the Intermediate Biology Selective, CMDB Selective I, CMDB Selective II, or the Biology Selective may NOT overlap (i.e., courses completed can be used for only one requirement -- #9 or #10 or #11 or #12 -- and must NOT overlap).

[2] This course may count for a Biology Selective and as the College of Science Great Issues requirement.

[3] This course may count for a Biology Selective and toward the Base Lab Requirement.
