

SYSTEMS & SYNTHETIC BIOLOGY, BACHELOR OF SCIENCE

College of Biological Sciences

The Systems & Synthetic Biology major provides students with a broad understanding of these two related and interdisciplinary fields. Systems Biology aims to understand how complex organismal properties and structures arise from simple components and interactions, and to identify design principles common to many types of biological regulation. Synthetic Biology focuses on the modification (or, ultimately, de novo construction) of organisms to generate novel pathways and processes. This major emphasizes integrative, computational and quantitative approaches to solving biological problems and engineering new biological outcomes.

The Program

In the freshman and sophomore years, students majoring in Systems & Synthetic Biology build a broad scientific background, taking courses in chemistry, biology, physics, and mathematics as well as an introduction course to computing for biologists. As juniors or seniors, students can enroll in courses that introduce them to the fundamental principles in mathematics, computer science, systems theory and application, and biological engineering.

Career Alternatives

The biotech workforce has a growing demand for biologists that are fluent in different merging disciplines that are covered by the Systems and Synthetic Biology Major. This combination of skills will allow graduates to work at the interface between biologists and engineers found in new emerging industries related to the pharmaceutical, biomedical, bioenergy, agricultural, nutrition, and microbiome industries. The program is also an excellent background for students wishing to enter graduate or other professional schools, including medicine, law, journalism or policy Honors & Honors Programs. Refer to the Academic Information section and the appropriate College section for Dean's Honors List information.

Faculty Advisor

Siobhan Brady, Ph.D.

The major requirements below are in addition to meeting University Requirements (<https://catalog.ucdavis.edu/undergraduate-education/university-degree-requirements/>) & College Requirements (<https://catalog.ucdavis.edu/undergraduate-education/college-degree-requirements/>); unless otherwise noted. The minimum number of units required for the Systems & Synthetic Biology Bachelor of Science major is 96.

Code	Title	Units
<i>Preparatory Subject Matter</i>		
Biological Sciences		16

BIO 001 & 001L & BIO 002 & BIO 002L & BIO 003	Introductory Biology: Ecology & Evolution and Introductory Biology Lab: Ecology & Evolution and Introductory Biology: Molecules to Cells and Introductory Biology Lab: Molecules to Cells and Introductory Biology: Cells Through Organisms	
BIS 015L or BIS 015LV	Introduction to Data Science for Biologists	
Chemistry		21-27
CHE 002A & CHE 002B & CHE 002C	General Chemistry and General Chemistry and General Chemistry	
OR		
CHE 004A & CHE 004B & CHE 004C	General Chemistry for the Physical Sciences & Engineering and General Chemistry for the Physical Sciences & Engineering and General Chemistry for the Physical Sciences & Engineering	
AND		
CHE 008A & CHE 008B	Organic Chemistry: Brief Course and Organic Chemistry: Brief Course	
OR		
CHE 118A & CHE 118B & CHE 118C	Organic Chemistry for Health & Life Sciences and Organic Chemistry for Health & Life Sciences and Organic Chemistry for Health & Life Sciences	
Mathematics		8-12
MAT 017A & MAT 017B & MAT 017C	Calculus for Biology & Medicine and Calculus for Biology & Medicine and Calculus for Biology & Medicine	
OR		
MAT 021A & MAT 021B & MAT 021C	Calculus and Calculus and Calculus (Recommended)	
Physics		12
PHY 007A & PHY 007B & PHY 007C	General Physics and General Physics and General Physics	
Preparatory Subject Matter Subtotal		57-67
<i>Depth Subject Matter</i>		
Statistics		8
STA 100	Applied Statistics for Biological Sciences	
STA 101	Advanced Applied Statistics for the Biological Sciences	
or STA 106	Applied Statistical Methods: Analysis of Variance	
or STA 108	Applied Statistical Methods: Regression Analysis	
Genetics		4
BIS 101	Genes & Gene Expression	
or BIS 101V	Genes & Gene Expression	
Biochemistry, Bioenergetics, & Metabolism		3-6

BIS 105	Biomolecules & Metabolism	
or (BIS 102 OR BIS 102V)	and Bioenergetics & Metabolism	
& BIS 103		
Cell Biology		3
BIS 104	Cell Biology	
Systems Biology		3
SSB 134	Systems Biology: From Biological Circuits to Biological Systems	
Biomolecular Systems Engineering		4
BIM 143	Biomolecular Systems Engineering: Synthetic Biology	
Systems & Synthetic Biology		5
BIS 185L	Systems & Synthetic Biology Lab	
Molecular & Cellular Biology		3
MCB 121	Advanced Molecular Biology	
<i>Restricted Electives</i>		
Choose at least 6 additional units from:		6
BIM 105	Probability & Data Science for Biomedical Engineers	
BIM 117	Modeling Strategies for Biomedical Engineering	
BIM 140	Protein Engineering	
BIM 140L	Protein Engineering Laboratory	
BIM 152	Molecular Control of Biosystems	
BIS/MAT 107	Probability & Stochastic Processes with Applications to Biology	
BIS 180L	Genomics Laboratory	
BIS 183	Functional Genomics	
BIT 150	Applied Bioinformatics	
BIT 160	Principles of Plant Biotechnology	
BIT 161B	Plant Genetics & Biotechnology Laboratory	
EBS 161	Kinetics & Bioreactor Design	
MCB 120	Molecular Biology & Biochemistry Laboratory Associated Lecture	
MCB 120L	Molecular Biology & Biochemistry Laboratory	
MCB 123	Behavior & Analysis of Enzyme & Receptor Systems	
MCB 124	Macromolecular Structure & Function	
MCB/PLB 126	Plant Biochemistry	
MCB 160L	Principles of Genetics Laboratory	
MCB 182	Principles of Genomics	
MMG 102	Introductory Microbiology	
or MIC 102 DISCONTINUED FOR FALL 2026 **		
MMG 103L	Introductory Microbiology Laboratory	
or MIC 103L DISC		
MMG 115	Recombinant DNA Cloning & Analysis	
or MIC 115 DISCONTINUED FOR WINTER 2025 **		
MMG 170	Yeast Molecular Genetics	
or MIC 170 DISC		
Depth Subject Matter Total		39-42
Total Units		96-109

** Course(s) discontinued; see your advisor for course options.