BIOTECHNOLOGY, BACHELOR OF SCIENCE

College of Agricultural & Environmental Sciences

Every living organism, from the smallest and most primitive bacteria to every plant, insect, animal or human being, contains DNA as the primary genetic material. DNA directs all cellular processes, creating the incredible variety and diversity of living organisms in the biosphere. Biotechnology focuses on the mechanics of life processes and their application. Biotechnology means "life technology" and represents an integrated, multidisciplinary field, with a profound impact today on almost every aspect of human endeavor.

Preparatory Requirements

UC Davis students who wish to change their major to Biotechnology must complete the following courses (representing the subject areas of Biological Sciences, Chemistry, and Mathematics) with a grade point average of at least 2.500 in each subject area. All of these courses must be taken for a letter grade:

Code	Title	Units
Biological Sciences		
BIS 002A & BIS 002B & BIS 002C	Introduction to Biology: Essentials of Life on Earth and Introduction to Biology: Principles of Ecology & Evolution and Introduction to Biology: Biodiversity & the Tree of Life	15
Chemistry		
One series:		15
CHE 002A & CHE 002B & CHE 002C	General Chemistry and General Chemistry and General Chemistry	
CHE 003A & CHE 003B & CHE 003C	Chemistry for Life Sciences: Determining Structure & Predicting Properties and Chemistry for Life Sciences: Predicting & Characterizing Chemical Change and Chemistry for Life Sciences: Controlling Processes & Synthetic Pathways	
Mathematics		
One series:		6-8
MAT 016A & MAT 016B DISCONTINUED	and (Discontinued) [1]	
MAT 017A & MAT 017B	Calculus for Biology & Medicine and Calculus for Biology & Medicine	
MAT 019A & MAT 019B	Calculus for Data-Driven Applications and Calculus for Data-Driven Applications	
MAT 021A & MAT 021B	Calculus and Calculus	

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MAT 016A & MAT 016B are discontinued.

The Program

In the first two years, students develop a strong and general background in biological science with an emphasis on fundamental concepts and basic principles of genetics, molecular biology and cell biology. Four options, Animal Biotechnology, Plant Biotechnology, Fermentation/ Microbial Biotechnology, and Bioinformatics, provide in-depth training and specialized knowledge in an aspect of biotechnology. Each option has a strong laboratory component to reinforce the theoretical concepts. Students also do an internship in a biotechnology company or university or government laboratory.

Internships & Career Opportunities

In the last decade, more industries are turning to biotechnology to solve problems and improve products, creating a growing job market for individuals trained in biotechnology in the agricultural, food and beverage, health care, chemical, pharmaceutical and biochemical, and environmental and bioremediation industries.

Graduates trained in the technologies designed for biotechnology will find their training applicable to advanced research in molecular biology, genetics, biochemistry, and the plant and animal sciences.

Lead Faculty Advisor

Diane Beckles in 133 Asmundson Hall (https://www.plantsciences.ucdavis.edu/people/diane-beckles/)

Faculty includes members of the Departments of Animal Science; Engineering: Chemical Engineering & Materials Science; Computer Science; Engineering: Biological & Agricultural; Food Science & Technology; Land, Air, & Water Resources; Plant Pathology; Plant Sciences; Viticulture & Enology; and the College of Biological Sciences.

Major Advisor

Advising Center for the major is located in 1220 Plant & Environmental Sciences; plsadvising@ucdavis.edu.

The major requirements below are in addition to meeting University Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/university-degree-requirements/) & College Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/college-degree-requirements/); unless otherwise noted. The minimum number of units required for the Biotechnology Bachelor of Science is 114.

Code	Title	Units
Preparatory Subject Matter		
Biological Science		*15*
BIS 002A	Introduction to Biology: Essentials of Life on Earth	
BIS 002B	Introduction to Biology: Principles of Ecology & Evolution	
BIS 002C	Introduction to Biology: Biodiversity & the Tree of Life	
Biotechnology		*5*
BIT 001Y	Introduction to Biotechnology	
BIT 091	Undergraduate Seminars in Biotechnology	
Chemistry		*21-27*
002 series:		

CHE 002A	General Chemistry	
& CHE 002B	and General Chemistry	
& CHE 002C	and General Chemistry	
Choose CHE 008 series or 118 series or 128 series & 129A:		
CHE 008A	Organic Chemistry: Brief Course	
& CHE 008B	and Organic Chemistry: Brief Course	
OR		
CHE 118A	Organic Chemistry for Health & Life Sciences	
& CHE 118B	and Organic Chemistry for Health & Life Sciences	
& CHE 118C	and Organic Chemistry for Health & Life Sciences	
OR		
CHE 128A	Organic Chemistry	
& CHE 128B	and Organic Chemistry	
& CHE 128C	and Organic Chemistry	
CHE 129A	Organic Chemistry Laboratory	
Mathematics		
Choose a series:		6-8
MAT 016A	and (Discontinued)	
& MAT 016B DISCONTINUED		
MAT 017A	Calculus for Biology & Medicine	
& MAT 017B	and Calculus for Biology & Medicine	
MAT 019A	Calculus for Data-Driven Applications	
& MAT 019B	and Calculus for Data-Driven Applications	
MAT 021A	Calculus	
& MAT 021B	and Calculus	
Physics		*8*
PHY 007A	General Physics	
PHY 007B	General Physics	
Choose one:		4
PLS 120	Applied Statistics in Agricultural Sciences	
STA 100	Applied Statistics for Biological Sciences	
Choose one:		4
May overlap with the English Composition Requirement; may be waived by passing the upper division composition exam.		
UWP 101	Advanced Composition	
or UWP 101V	Advanced Composition	
or UWP 101Y	Advanced Composition	
UWP 102A	Writing in the Disciplines: Special Topics	
UWP 102B	Writing in the Disciplines: Biology	
UWP 102D	Writing in the Disciplines: International Relations	
UWP 102E	Writing in the Disciplines: Engineering	
UWP 102F	Writing in the Disciplines: Food Science & Technology	
UWP 102G	Writing in the Disciplines: Environmental Writing	
UWP 104A	Writing in the Professions: Business Writing	
or UWP 104AV	Writing in the Professions: Business Writing	
or UWP 104AY	Writing in the Professions: Business Writing	
UWP 104B	Writing in the Professions: Law	
UWP 104C	Writing in the Professions: Journalism	
UWP 104D	Writing in the Professions: Elementary & Secondary Education	
UWP 104E	Writing in the Professions: Science	
UWP 104F	Writing in the Professions: Health	
or UWP 104FV	Writing in the Professions: Health	
or UWP 104FY	Writing in the Professions: Health	
UWP 104T	Writing in the Professions: Technical Writing	
Preparatory Subject Matter Subtotal		63-71
Depth Subject Matter		
Biological Science		*10-17*
BIS 101	Genes & Gene Expression	
or BIS 101V	Genes & Gene Expression	
BIS 104	Cell Biology	
Choose BIS 105, or BIS 102 & BIS 103, or ABI 102 & ABI 103:		
BIS 105	Biomolecules & Metabolism	
OR		
BIS 102	Structure & Function of Biomolecules	
& BIS 103	and Bioenergetics & Metabolism	
OR		
ABI 102	Animal Biochemistry & Metabolism	
& ABI 103	and Animal Biochemistry & Metabolism	
Biotechnology		*3*
BIT 171	Professionalism & Ethics in Genomics & Biotechnology	
Microbiology		*3*
MIC 102	Introductory Microbiology	
Molecular & Cellular Biology		*3*
MCB 121	Advanced Molecular Biology	
Internship or Independent Research		
Must be approved by major advisor		
Choose one:		3
BIT 189L	Laboratory Research in Genomics & Biotechnology	
BIT 192	Internship in Biotechnology	
BIT 199	Special Study for Advanced Undergraduates	
The following two courses are optional:		
BIT/PLS 188	Undergraduate Research Proposal	
BIT 194H	Honors Thesis in Biotechnology	
Depth Subject Matter Subtotal		22-29
Areas of Specialization		
Choose one:		29-31
Fermentation/Microbiology Biotechnology Option (p. 3)		
Plant Biotechnology Option (p. 3)		
Animal Biotechnology Option (p. 4)		
Bioinformatics Option (p. 4)		
Areas of Specialization Subtotal		29-31
Total Units		**114-131**

Fermentation/Microbiology Biotechnology Option

Code	Title	Units
Fermentation/Microbiology Biotechnology Option		
BIT 161A	Genetics & Biotechnology Laboratory	5-6
or MCB 160L	Principles of Genetics Laboratory	
FST 104L	Food Microbiology Laboratory	3-4
or MIC 104L	General Microbiology Laboratory	
Choose one:		3
MIC 140	(Discontinued)	
MIC 150	(Discontinued)	
MMG 115	Recombinant DNA Cloning & Analysis	
or MIC 115 DISCONTINUED		
MMG 120	Microbial Ecology	
or MIC 120 DISC		
MMG 170	Yeast Molecular Genetics	
or MIC 170 DISCONTINUED		
PLP 130	Fungal Biology & Disease	
AND		
Choose one from the previous list or below:		3
BIS 181	Comparative Genomics	
BIS 183	Functional Genomics	
MCB 182	Principles of Genomics	
Restricted Electives		
Choose 15 units:		15
BIS 132	(Discontinued)	
BIS 181	Comparative Genomics	
BIS 183	Functional Genomics	
BIT 150	Applied Bioinformatics	
BIT 161B	Plant Genetics & Biotechnology Laboratory	
BIT 188	Undergraduate Research Proposal	
CHE 107A	Physical Chemistry for the Life Sciences	
CHE 107B	Physical Chemistry for the Life Sciences	
CHE 130A	Principles of Medicinal Chemistry	
CHE 130B	Computational Drug Design	
ECH 161C	Biotechnology Facility Design & Regulatory Compliance	
ECH 161L	Bioprocess Engineering Laboratory	
ECS 124	Theory & Practice of Bioinformatics	
ECS 129	Computational Structural Bioinformatics	
EVE 100	Introduction to Evolution	
FST 102A	Malting & Brewing Science	
FST 102B	Practical Malting & Brewing	
FST 104	Food Microbiology	
FST 104L	Food Microbiology Laboratory	
FST 110	Food Processing	
FST/VEN 114	Fermented Foods	
FST 123	Introduction to Enzymology	
FST 123L	Enzymology Laboratory	
MCB 120L	Molecular Biology & Biochemistry Laboratory	
MCB 182	Principles of Genomics	
MCB 164	(Discontinued)	
MIC 105	Microbial Diversity	
MIC 105L	Microbial Diversity Laboratory	
MIC 140	(Discontinued)	
MIC 150	(Discontinued)	
MIC 155L	(Discontinued)	
MMG 115	Recombinant DNA Cloning & Analysis	
MMG 120	Microbial Ecology	
or MIC 120 DISC		
MMG 162	General Virology	
or MIC 162 DISCONTINUED		
MMG 170	Yeast Molecular Genetics	
or MIC 170 DISC		
PLP 130	Fungal Biology & Disease	
PLP 140	(Discontinued)	
PLS 174	Microbiology & Safety of Fresh Fruits & Vegetables	
VEN 124	Wine Production	
VEN 124L	Wine Production Laboratory	
VEN 128	Wine Microbiology	
VEN 135	Wine Technology & Winery Systems	
Total Units		**29-31**

Plant Biotechnology Option

Code	Title	Units
Plant Biotechnology Option		
Biotechnology		13
BIT 160	Principles of Plant Biotechnology	
BIT 161A	Genetics & Biotechnology Laboratory	
BIT 161B	Plant Genetics & Biotechnology Laboratory	
Microbiology		*2*
MIC 103L	Introductory Microbiology Laboratory	
Molecular & Cellular Biology		*3*
MCB/PLB 126	Plant Biochemistry	
Plant Science		*4*
PLS 152	Plant Genetics	
Restricted Electives		
Choose 9 units:		9
BIS 181	Comparative Genomics	
BIS 183	Functional Genomics	
BIT 150	Applied Bioinformatics	
BIT 188	Undergraduate Research Proposal	
CHE 130A	Principles of Medicinal Chemistry	
CHE 130B	Computational Drug Design	
EBS 075	Properties of Materials in Biological Systems	
EBS 289G	Selected Topics in Biological Systems Engineering: Forest Engineering	
EBS 289I	Selected Topics in Biological Systems Engineering: Plant Production & Harvest	
EBS 289J	Selected Topics in Biological Systems Engineering: Postharvest Engineering	
ECS 124	Theory & Practice of Bioinformatics	

ECS 129	Computational Structural Bioinformatics
ENT 110	Arthropod Pest Management
EVE 100	Introduction to Evolution
FST 104	Food Microbiology
FST 104L	Food Microbiology Laboratory
FST 110	Food Processing
FST 123	Introduction to Enzymology
FST 123L	Enzymology Laboratory
MCB 120L	Molecular Biology & Biochemistry Laboratory
MCB 164	(Discontinued)
MCB 182	Principles of Genomics
MMG 115	Recombinant DNA Cloning & Analysis
or MIC 115 DISC	
MMG 162	General Virology
or MIC 162 DISCONTINUED	
NEM 100	Introduction to Nematode Parasites
or NEM 110	Introduction to Nematology
PLB 105	Developmental Plant Anatomy
PLB 111	Plant Physiology
PLB 112	Plant Growth & Development
PLB 113	Molecular & Cellular Biology of Plants
PLB 143	Evolution of Crop Plants
PLP 120	Introduction to Plant Pathology
PLP/ENT/PLB 123	Plant-Virus-Vector Interaction
PLP 130	Fungal Biology & Disease
PLP 140	(Discontinued)
PLS 100A	Metabolic Processes of Cultivated Plants
PLS 100AL	Metabolic Processes of Cultivated Plants Laboratory
PLS 100B	Growth & Yield of Cultivated Plants
PLS 100BL	Growth & Yield of Cultivated Plants Laboratory
PLS 100C	Environmental Interactions of Cultivated Plants
PLS 100CL	Environmental Interactions of Cultivated Plants Laboratory
PLS 153	(Discontinued)
PLS 154	Introduction to Plant Breeding
PLS 157	Physiology of Environmental Stresses in Plants
PLS 158	Mineral Nutrition of Plants
PLS 172	Biology and Quality of Harvested Crops
PLS 173	(Discontinued)
PLS 174	Microbiology & Safety of Fresh Fruits & Vegetables
Total Units	**31**

Animal Biotechnology Option

Code	Title	Units
Animal Biotechnology Option		
Animal Genetics		*4*
ANG 111	Molecular Biology Laboratory Techniques	
Animal Science		*4*
ANS 170	Ethics of Animal Use	
Microbiology		*2*
MIC 103L	Introductory Microbiology Laboratory	
Molecular & Cellular Biology		*6-7*
MCB 150	Developmental Biology	
or MCB 163	Developmental Genetics	
MCB 182	Principles of Genomics	
Neurobiology, Physiology, & Behavior		*5*
NPB 101	Systemic Physiology	
Restricted Electives		
Choose 9 units:		9
ANG 101	Animal Cytogenetics	
ANG 107	Genetics & Animal Breeding	
ANS 131	Reproduction & Early Development in Aquatic Animals	
ANS 140	Management of Laboratory Animals	
AVS 103	Avian Development & Genomics	
AVS 121	Avian Reproduction	
BIS 181	Comparative Genomics	
BIS 183	Functional Genomics	
BIT 150	Applied Bioinformatics	
BIT 161A	Genetics & Biotechnology Laboratory	
BIT 161B	Plant Genetics & Biotechnology Laboratory	
BIT 188	Undergraduate Research Proposal	
EVE 100	Introduction to Evolution	
EVE 102	Population & Quantitative Genetics	
MCB 120	Molecular Biology & Biochemistry Laboratory Associated Lecture	
MCB 160L	Principles of Genetics Laboratory	
MCB 164	(Discontinued)	
MCP 200L	Animal Cell Culture Laboratory	
MMG 115	Recombinant DNA Cloning & Analysis	
or MIC 115 DISCONTINUED		
MMG 162	General Virology	
or MIC 162 DISC		
MMI 188	(Discontinued)	
NPB 121	Physiology of Reproduction	
NPB 121L	Physiology of Reproduction Laboratory	
NPB 132	Nature vs. Nurture: Physiological Interactions Among Genes, Nutrients & Health	
PLP 140	(Discontinued)	
PMI 126	Fundamentals of Immunology	
PMI 126L	Immunology Laboratory	
PMI 127	Medical Bacteria & Fungi	
PMI 128	Biology of Animal Viruses	
Total Units		**30-31**

Bioinformatics Option

Code	Title	Units
Bioinformatics Option		
Biological Science		*3*

BIS 181	Comparative Genomics	
or BIS 183	Functional Genomics	
Biotechnology		*4*
BIT 150	Applied Bioinformatics	
Choose one:		4-5
BIS 180L	Genomics Laboratory	
ECS 124	Theory & Practice of Bioinformatics	
ECS 129	Computational Structural Bioinformatics	
Computer Science Engineering		*4*
ECS 032A	Introduction to Programming	
or ECS 032AV	Introduction to Programming	
Microbiology		*2*
MIC 103L	Introductory Microbiology Laboratory	
Molecular & Cellular Biology		*3*
MCB 182	Principles of Genomics	
Restricted Electives		
Choose 9 units:		9
ANG 212	Sequence Analysis in Molecular Genetics	
BIS 132	(Discontinued)	
BIS 134	(Discontinued)	
BIS 181	Comparative Genomics	
BIS 183	Functional Genomics	
BIT 188	Undergraduate Research Proposal	
EAD 289D	Special Topics in Applied Science: Biophotonics/Biotechnology	
ECS 020	Discrete Mathematics For Computer Science	
ECS 032B	Introduction to Data Structures	
ECS 034	Software Development in UNIX & C++	
ECS 050	Computer Organization & Machine-Dependent Programming	
ECS 122A	Algorithm Design & Analysis	
ECS 124	Theory & Practice of Bioinformatics	
ECS 129	Computational Structural Bioinformatics	
ECS 140A	Programming Languages	
ECS 150	Operating Systems & System Programming	
ECS 154A	Computer Architecture	
EVE 100	Introduction to Evolution	
EVE 102	Population & Quantitative Genetics	
EVE 103	Phylogeny, Speciation & Macroevolution	
EVE 131	Human Genetic Variation & Evolution	
EVE 161	Microbial Phylogenomics; Genomic Perspectives on the Diversity & Diversification of Microbes	
MAT 124	Mathematical Biology	
MCB 162	Human Genetics & Genomics	
MMG 115	Recombinant DNA Cloning & Analysis	
or MIC 115 DISC		
NPB 132	Nature vs. Nurture: Physiological Interactions Among Genes, Nutrients & Health	
STA 130A	Mathematical Statistics: Brief Course	
STA 130B	Mathematical Statistics: Brief Course	
STA 131A	Introduction to Probability Theory	
STA 131B	Introduction to Mathematical Statistics	
STA 141A	Fundamentals of Statistical Data Science	
Total Units		**29-30**