

BIOTECHNOLOGY, BACHELOR OF SCIENCE

College of Agricultural & Environmental Sciences

Faculty

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.

The Major Program

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	Short Calculus and Short Calculus	
MAT 071A & MAT 017B	Explorations in Elementary Mathematics and Calculus for Biology & Medicine	

MAT 021A & MAT 021B Calculus and Calculus

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.

Major Advisor

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

Advising Center for the major is located in 1220A Plant & Environmental Sciences; 530-752-9770.

Code	Title	Units
Preparatory Subject Matter		
<i>Biological Science</i>		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	
<i>Biotechnology</i>		5
BIT 001Y	Introduction to Biotechnology	
BIT 091	Undergraduate Seminars in Biotechnology	
<i>Chemistry</i>		21-27
002 series:		
CHE 002A & CHE 002B & CHE 002C	General Chemistry and General Chemistry and General Chemistry	
Choose CHE 008 series or 118 series or 128 series & 129A:		
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	

or	
CHE 128A & CHE 128B & CHE 128C	Organic Chemistry and Organic Chemistry and Organic Chemistry
CHE 129A	Organic Chemistry Laboratory
Mathematics	
Choose a series:	6-8
MAT 016A & MAT 016B	Short Calculus and Short Calculus
MAT 017A & MAT 017B	Calculus for Biology & Medicine and Calculus for Biology & Medicine
MAT 021A & MAT 021B	Calculus 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
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
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
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
BIS 104	Cell Biology
Choose BIS 105 or 102 & 103 or ABI 102 & 103:	
BIS 105	Biomolecules & Metabolism
or	
BIS 102 & BIS 103	Structure & Function of Biomolecules and Bioenergetics & Metabolism
or	

ABI 102 & ABI 103	Animal Biochemistry & Metabolism 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 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. 2)		
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 or MCB 160L	Genetics & Biotechnology Laboratory Principles of Genetics Laboratory	5-6
FST 104L or MIC 104L	Food Microbiology Laboratory General Microbiology Laboratory	3-4
Choose one:		3
MIC 115	Recombinant DNA Cloning & Analysis	
MIC 120	Microbial Ecology	
MIC 140	Bacterial Physiology	
MIC 150	Genomes of Pathogenic Bacteria	
MIC 170	Yeast Molecular Genetics	
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	Pharmaceutical Chemistry
CHE 130B	Pharmaceutical Chemistry
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 114	Fermented Foods
FST 123	Introduction to Enzymology
FST 123L	Enzymology Laboratory
MIC 105	Microbial Diversity
MIC 105L	Microbial Diversity Laboratory
MIC 115	Recombinant DNA Cloning & Analysis
MIC 120	Microbial Ecology
MIC 140	Bacterial Physiology
MIC 150	Genomes of Pathogenic Bacteria
MIC 155L	Bacterial Physiology Lab
MIC 162	General Virology
MIC 170	Yeast Molecular Genetics
MCB 120L	Molecular Biology & Biochemistry Laboratory
MCB 164	Advanced Eukaryotic Genetics
MCB 182	Principles of Genomics
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
<i>Microbiology</i>	2
MIC 103L	Introductory Microbiology Laboratory
<i>Molecular & Cellular Biology</i>	3
MCB 126	Plant Biochemistry
<i>Plant Science</i>	4
PLS 152	Plant Genetics
<i>Restricted Electives</i>	
Choose 9 units:	9
BIS 181	Comparative Genomics
BIS 183	Functional Genomics
BIT 150	Applied Bioinformatics
BIT 188	Undergraduate Research Proposal
CHE 130A	Pharmaceutical Chemistry
CHE 130B	Pharmaceutical Chemistry
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	Advanced Eukaryotic Genetics
MCB 182	Principles of Genomics
MIC 115	Recombinant DNA Cloning & Analysis
MIC 162	General Virology
NEM 100 or NEM 110	Plant Nematology 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 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	Plant, Cell, Tissue & Organ Culture
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	Molecular & Cellular Aspects of Postharvest Biology
PLS 174	Microbiology & Safety of Fresh Fruits & Vegetables

Total Units 31

Animal Biotechnology Option

Code	Title	Units
Animal Biotechnology Option		
<i>Animal Genetics</i> 4		
ANG 111	Molecular Biology Laboratory Techniques	
<i>Animal Science</i> 4		
ANS 170	Ethics of Animal Use	
<i>Microbiology</i> 2		
MIC 103L	Introductory Microbiology Laboratory	
<i>Molecular & Cellular Biology</i> 6-7		
MCB 150	Developmental Biology	
or MCB 163	Developmental Genetics	
MCB 182	Principles of Genomics	
<i>Neurobiology, Physiology, & Behavior</i> 5		
NPB 101	Systemic Physiology	
<i>Restricted Electives</i>		
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	Advanced Eukaryotic Genetics
MCP 200L	Animal Cell Culture Laboratory
MIC 115	Recombinant DNA Cloning & Analysis
MIC 162	General Virology
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		
<i>Biological Science</i> 3		
BIS 181	Comparative Genomics	
or BIS 183	Functional Genomics	
<i>Biotechnology</i> 4		
BIT 150	Applied Bioinformatics	
Choose one: 4-5		
BIS 180L	Genomics Laboratory	
ECS 124	Theory & Practice of Bioinformatics	
ECS 129	Computational Structural Bioinformatics	
<i>Computer Science Engineering</i> 4		
ECS 032A	Introduction to Programming	
<i>Microbiology</i> 2		
MIC 103L	Introductory Microbiology Laboratory	
<i>Molecular & Cellular Biology</i> 3		
MCB 182	Principles of Genomics	
<i>Restricted Electives</i>		
Choose 9 units: 9		
ANG 212	Sequence Analysis in Molecular Genetics	
BIS 132	(Discontinued)	
BIS 134	Systems Biology: From Biological Circuits to Biological Systems	
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
MIC 115	Recombinant DNA Cloning & Analysis
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**