

January 4, 2026

To: Kenneth N. Barish, Chair  
Riverside Division of the Academic Senate

Re: BS in Genetics and Molecular Biotechnology

I am writing to request a vote for approval by the Academic Senate for the Bachelor of Science degree in Genetics and Molecular Biotechnology (GNBT) proposed herein.

The second round of Senate review was positive overall. The School of Public Policy suggested including alternatives to the PSYC 178 (Health Psychology) requirement for the Pre-Genetic Counseling Track. We have identified courses that would be likely to fulfill the entrance requirements for Genetic Counseling postgraduate programs we surveyed and that do not have too many prerequisites. We have now added PBPL 160 (Immigrant Health and Wellbeing), PBPL 167/SOC 167 (Medical Sociology), PBPL 127/SOC 127 (Sociological Determinants of Health), and PBPL 162 (Health in All Policies) as alternatives to PSYC 178.

Recent discussions with representatives from the Bioengineering (BIEN) department have resolved their concerns about the use of "Biotechnology" in the name of the proposed major. We now propose to name the program "Genetics and **Molecular** Biotechnology" and have removed the references to Bioengineering that were originally inserted into the catalog description in order to clarify differences in the scopes of GNBT and BIEN. This change has received enthusiastic approval from BIEN.

The revised proposal was approved by the BPSC department on Dec 30, 2025 (18 in favor of the proposed changes; 0 against; 1 abstention).

Please see the attached documents for the revised catalog description, a letter of support from BIEN, the revised degree proposal with changes tracked, and Appendices IV-VI that include comments collected and responded to in the prior rounds of review.

Sincerely,



Professor of Genetics  
Botany and Plant Sciences  
University of California, Riverside  
[david.nelson@ucr.edu](mailto:david.nelson@ucr.edu)  
(951) 827-4397

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## Enthusiastic approval from BIEN faculty about the proposed changes to GNBT major

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**William Grover** <wgrover@ucr.edu>

Wed, Nov 26, 2025 at 10:01 AM

To: Xiaoping Hu <xiaophu@ucr.edu>, david.nelson@ucr.edu, Chung-Hao Lee <chunghal@ucr.edu>, Sean Cutler <sean.cutler@ucr.edu>, Thomas Eulgem <teulgem@ucr.edu>

Hello Dave, Sean, and Thomas,

Thanks again for meeting with us yesterday. We shared with our colleagues your proposed changes to the planned major (specifically, removing mentions of the Bioengineering major from the catalog description, and changing the name of the major to "Genetics and Molecular Biotechnology").

**The consensus was that we enthusiastically support these changes, and we're very grateful for your flexibility and willingness to accommodate our requests.**

We'll also communicate this information to the BCOE Executive Council so that they (and the Senate) know that we enthusiastically support this major once the two proposed changes are made.

Thank you!

—Will

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**EXECUTIVE COMMITTEE  
COLLEGE OF NATURAL AND AGRICULTURAL SCIENCES  
REPORT TO THE RIVERSIDE DIVISION  
MAY 20, 2025DECEMBER 19, 2025**

To be adopted: Proposed new B.S. in Genetics and Molecular Biotechnology Major

**PROPOSED:**

**Major**

The B.S. in Genetics and Molecular Biotechnology major is designed to prepare UCR undergraduates for careers that involve genetic discovery, interpreting genetic information, and/or using genetic knowledge to create novel solutions to problems facing human health, food production, or the environment. This program emphasizes the development of practical skills for entering the workforce directly after graduation or pursuing postgraduate studies, including training in current laboratory and computational methods for genetic analysis and manipulation, analysis of scientific literature, and critical thinking. After establishing a foundation of basic genetic and biological principles, students may specialize in one of three tracks: Genetics and Genomics, Pre-Genetic Counseling, or Genetic-Molecular Biotechnology. The Genetics and Genomics track provides broad training in genetic theories and analysis. The Pre-Genetic Counseling track has a reduced lab requirement and focuses on the typical prerequisites for postgraduate genetic counseling programs. It provides preparation for working with human genetic data that may be applicable to healthcare settings. The Genetic-Molecular Biotechnology track offers more opportunities for organism-specific training in preparation for careers in the biomedical, microbial, or plant biotechnology industries. This track is focused on modifying living systems through genetic manipulation. ~~Students interested in biomedical engineering (e.g., developing artificial limbs or organs, sensors, or medical devices) should enroll instead in the Bioengineering major of the Bourns College of Engineering.~~

**Transfer Students**

Students planning to transfer to UCR with a major in Genetics and Molecular Biotechnology must have a minimum GPA of 2.7 in transferable college courses and “C” or higher grades in a one-year sequence of general chemistry and in courses equivalent to our BIOL 005A, BIOL 05LA, and BIOL 005B. We also require that transfer students complete two quarters of college calculus (equivalent to our MATH 007A and 007B or our MATH 009A and MATH 009B) before admission. Exceptions may be granted by the faculty advisor.

### **Major Requirements**

#### **Genetics and Genomics, Pre-Genetic Counseling, or Genetic-Molecular Biotechnology Tracks**

##### **Core Requirements**

###### **1. Lower-division requirements (72-73 units)**

Students must complete all required Core Curriculum courses with a grade of C- or better and with a cumulative GPA in the courses of at least 2.0. Grades of D or F in two required courses, either separate courses or repetitions of the same course, are grounds for discontinuation from the major.

- a) BIOL 005A, BIOL 05LA or BIOL 020, BIOL 005B, BIOL 005C
- b) CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC or CHEM 01HA, CHEM 01HB, CHEM 01HC, CHEM 1HLA, CHEM 1HLB, CHEM 1HLC
- c) CHEM 008A, CHEM 008B, CHEM 008C, CHEM 008LA, CHEM 008LB, CHEM 008LC or CHEM 08HA, CHEM 08HB, CHEM 08HC, CHEM 08HLA, CHEM 08HLB, CHEM 08HLC
- d) MATH 007A or MATH 009A or MATH 09HA, MATH 007B or MATH 009B or MATH 09HB
- e) PHYS 002A, PHYS 002B, PHYS 002C, PHYS 02LA, PHYS 02LB, PHYS

02LC or PHYS 02HA, PHYS 02HB, PHYS 02HC, PHYS 02HLA, PHYS 02HLB, PHYS 02HLC or PHYS 040A, PHYS 040B, PHYS 040C or PHYS 040HA, PHYS 040HB, PHYS 040HC

f) STAT 010

g) GNBT 010

**2. Upper-division requirements (24 units)**

a) BCH 100 or BCH 100H or BCH 110A or BCH 110HA

b) BIOL 102, BIOL 107A or BCH 110C or BCH 110HC, GNBT 100, GNBT 110, GNBT 114

**Genetics and Genomics Track**

**1. Upper-division requirements (16-20 units)**

a) GNBT 130

b) One laboratory course: GNBT 120 or BIOL118 or MCBL 121L/BIOL 121L or 4 units of GNBT 197/199\*

c) Two or more of the following (8-12 units):

BCH 185, BCH 188, BIOL 105, BIOL 107B, BIOL 108, BIOL 115, BIOL 119, BIOL 148/BPSC 148, BPSC 109/CBNS 109, BPSC 150, BPSC/ENTM 184, CBNS 108, CBNS 150/ENTX 150, CBNS 165, ENTM 101, ENTM 111, ENTM 112/BIOL 112/BPSC 112, MCBL 121/ BIOL 121, MCBL 139/ENTM 139

**Pre-Genetic Counseling Track**

**1. Upper-division requirements (16-20 units)**

a) GNBT 120 or GNBT 130 or BIOL107B or BIOL 119

b) One of the following: PSYC 178,  
PBPL 160, PBPL 167/SOC 167, PBPL  
127/SOC 127, or PBPL 162

c) Two or more of the following (8-12 units):

BCH 185, BCH 188, BIOL 107B,  
BIOL 108, BIOL 115, BIOL 118,  
BPSC 109/CBNS 109, BPSC  
148/BIOL 148, CBNS 108, CBNS  
121/PSYC 121, CBNS 150/ENTX  
150, CBNS 165, CBNS 169, ENTM  
111, ENTM 139/MCBL 139, GNBT  
120, GNBT 130, 4 units of GNBT  
197/199\*, MCBL 121/ BIOL 121,  
MCBL 123/BIOL 123/PLPA 123,  
MCBL 124/BIOL 124, MCBL 129

### **Genetic-Molecular Biotechnology Track**

1. Upper-division requirements (16-20 units)

a) One or two laboratory courses (4-8 units):

BPSC 104/BIOL 104, BPSC  
143/BIOL 143, GNBT 120, 4 units of  
GNBT 197/199\*, MCBL 121L/BIOL  
121L, PLPA 120/BIOL 120/MCBL  
120 and PLPA 120L/BIOL  
120L/MCBL 120L

b) Two or more of the following (8-16 units):

BCH 188, BIOL 107B, BIOL 119,  
BPSC 109/CBNS 109, BPSC 135,  
BPSC 148/BIOL 148, BPSC 149,  
BPSC 150, BSPC183,  
BPSC184/ENTX 184, CBNS 108,  
CBNS 150/ENTX 150, CBNS 165,  
ENSC 120/NEM 120, ENSC  
134/BPSC 134, ENTM 101, ENTM  
111, ENTM 125/ENTX 125/PLPA  
125, ENTM 126, ENTM 173/BIOL  
173, GNBT 130, MCBL 121/BIOL  
121, MCBL 123/BIOL 123/PLPA  
123, MCBL126, MCBL 127, MCBL  
129, MCBL 133/ENSC 133, MCBL  
139/ENTM 139, NEM 159/BIOL 159

\*GNBT 197/199 can be replaced by equivalent research-focused courses (e.g., BIOL 197/199, BPSC 197/199, etc.) with undergraduate advisor approval. Research pursued for credit of GNBT 197/199 or equivalent research-focused courses must be taken for letter grades and serve the training goals of the respective GNBT track.

**Note:** No more than 4 units of GNBT 197 or GNBT 199 may be used to fulfill major requirements. Additional units of GNBT 197 or GNBT199, or equivalent research-focused courses, may be used toward graduation.

**Justification:**

Genetic discoveries and their translation to biotechnological applications are at the forefront of modern advances in human health, agriculture, and environmental management. Individual genome sequencing gives consumers deeper knowledge of their ancestry and health risks that can guide approaches to preventative medicine as well as reproductive decisions. Personalized medicine matches pharmaceutical treatments with the genetic profile of a patient (or their cancer) to minimize side effects and maximize benefits. Vaccines and individualized cures for genetic diseases are being produced through genetic engineering. Food and agricultural biotechnology are improving food security by developing crops with increased resilience to climate change and pests, higher yields with more efficient utilization of agricultural inputs, cheaper and more sustainable sources of valuable natural products, and plant/microbe-based replacements for animal products. Environmental biotechnology is addressing global problems, such as climate change and pollution, through innovative solutions such as biological sequestration of carbon and biological remediation of environmental contaminants.

The goal of this major is to prepare UCR undergraduates for impactful, stimulating, and financially rewarding careers that involve genetic discovery, interpreting genetic information, and/or translating genetic knowledge to create new products through biotechnology. This B.S. degree program will give students a foundational understanding of genetics that can lead to jobs directly out of college or serve as a stepping-stone to more advanced degrees. A broad range of genetics-related careers in industry, government, and academia are possible, including laboratory scientist/technician, genetic counselor, forensic scientist, science/medical writer, bioprocessing specialist, bioinformatician, intellectual property/patent attorney, clinical geneticist, biotechnology salesperson/marketer, science teacher/professor, public health analyst, regulatory affairs officer, industry-government liaison, and science/health policy advisor (<https://www.ashg.org/careers-learning/career-flowchart/>). These careers are in demand. The life science industry, which is predominated by genetics and biotechnology, is a major economic engine for California. According to Biocom California's 2023 Life Science Economic Impact Report (<https://cabiootech.org/biotech-impact/economy/>), the biotechnology/life science industry generated \$413.7 billion in economic output in 2022. This sector is also experiencing some of the strongest job growth in California with a 6% increase in employment. San Diego, Los Angeles, and the Bay Area are three major hubs for biotechnology within the state and nationwide. The regional proximity of well-paying job opportunities in biotechnology will be valuable for UCR graduates, many of whom have strong social ties to the southern California region.

**Approvals:**

Approved by the faculty of the Department of Botany and Plant Sciences:

December 11, 2023

Approved by the Executive Committee of the

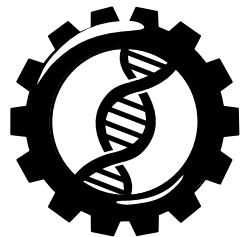
College of Natural and Agricultural Sciences:

March 5, 2024

Approved by the Committee on Educational Policy:

April 5, 2024

Proposal for a  
Bachelor of Science Degree Program in  
Genetics and Molecular Biotechnology



1. *Name of the academic program and the department(s) or unit(s) that will administer the program.*

Name: B.S. in Genetics and Molecular Biotechnology (GNBT)

Administration: The Genetics and Molecular Biotechnology major will be administered by the Department of Botany and Plant Sciences.

2. *A thorough justification, including the motivation for the creation of the program in terms of student interest and professional or academic importance.*

Genetic discoveries and their translation to biotechnological applications are at the forefront of modern advances in human health, agriculture, and environmental management. Individual genome sequencing gives consumers deeper knowledge of their ancestry and health risks that can guide approaches to preventative medicine as well as reproductive decisions. Personalized medicine matches pharmaceutical treatments with the genetic profile of a patient (or their cancer) to minimize side effects and maximize benefits. Vaccines and individualized cures for genetic diseases are being produced through genetic engineering. Food and agricultural biotechnology are improving food security by developing crops with increased resilience to climate change and pests, higher yields with more efficient utilization of agricultural inputs, cheaper and more sustainable sources of valuable natural products, and plant/microbe-based replacements for animal products. Environmental biotechnology is addressing global problems, such as climate change and pollution, through innovative solutions such as biological sequestration of carbon and biological remediation of environmental contaminants.

**The goal of this major is to prepare UCR undergraduates for impactful, stimulating, and financially rewarding careers that involve genetic discovery, interpreting genetic information, and/or translating genetic knowledge to create new products through molecular biotechnology.** This B.S. degree program will give students a foundational understanding of genetics that can lead to jobs directly out of college or serve as a stepping-stone to more advanced degrees. A broad range of genetics-related careers in industry, government, and academia are possible, including laboratory scientist/technician, genetic counselor, forensic scientist, science/medical writer, bioprocessing specialist, bioinformatician, intellectual property/patent attorney, clinical geneticist, biotechnology salesperson/marketer, science teacher/professor, public health analyst, regulatory affairs officer, industry-government liaison, and science/health policy advisor (<https://www.ashg.org/careers-learning/career-flowchart/>).

These careers are in demand. The life science industry, which is predominated by genetics and biotechnology, is a major economic engine for California. According to Biocom California's 2023 Life Science Economic Impact Report (<https://cabio.org/biotech-impact/economy/>), the biotechnology/life science industry generated \$413.7 billion in economic output in 2022. This sector is also experiencing some of the strongest job growth in California with a 6% increase in employment. San Diego, Los Angeles, and the Bay Area are three major hubs for biotechnology within the state and nationwide. The regional proximity of well-paying job opportunities in biotechnology will be valuable for UCR graduates, many of whom have strong social ties to the southern California region.

This program will also prepare undergraduates to enter advanced degree programs. For example, graduates of this program would be well-prepared to enter several genetics- and biotechnology-related M.S. degree options at UCR (e.g. Industrial Biotechnology) or the nearby Keck Graduate Institute (<https://www.kgi.edu/academics/degrees-certificates/>). For students interested in research, a robust background in genetics would be relevant preparation for a broad range of Ph.D. programs in biological sciences. For pre-medical students interested in human health-related careers, this degree will prepare them to integrate genetics into their future clinical work, and may help them stand out among a crowd of Biology majors. We envision that this major could be developed into a 4+1 M.S. program in the future.

Underscoring the importance of Genetics as a specialized discipline, many Tier 1 universities offer undergraduate majors in Genetics, Genomics, and/or Biotechnology. Within the UC system, UC Davis offers 1) Genetics and Genomics (B.S.) and 2) Biotechnology; UC Berkeley offers 1) Genetics and Plant Biology, and 2) Genetics, Genomics, Evolution, & Development; and UC Irvine offers Genetics (B.S.). Genetics majors are also found at many peer institutions outside the UC system, including the University of Wisconsin - Madison, Rutgers University, The Ohio State University, Purdue University, University of Georgia, and Michigan State University. The addition of a Genetics and Molecular Biotechnology undergraduate program to UCR would showcase the existing strengths of CNAS faculty in this area and help keep us competitive with peer institutions.

3. *Relationship of the new program to existing programs.*

Although UCR offers a PhD graduate program in Genetics, Genomics and Bioinformatics, it does not offer any undergraduate program with a major focus on these core elements of the modern biological curriculum. Several genetics-related courses are available for life-science undergraduate students, such as BIOL102 (Introductory Genetics) or BIOL107A (Molecular Biology), or more specialized courses such as BIOL148 (Quantitative Genetics). However, genetics education at UCR is quite fragmented across departments/programs with individual courses provided by EEOB, BPSC, ENTM, CBNS, MCBL, etc. In addition, there is insufficient depth in some foundational areas of genetics, such as genome composition across different kingdoms of life, how to analyze genomes and large-scale gene sequence datasets, and how genes are linked to their functions. GNBT will be a cohesive, intellectually grounded program that combines these existing courses with several new courses (see Appendix I-for course proposals) to provide well-rounded training in genetics.

The second major focus of GNBT, molecular biotechnology, concerns how genetic knowledge can be applied. This translational emphasis is important to students who are interested in making a direct impact on problems facing humanity, agriculture, and the environment. Biotechnology is partly covered by the UCR Bioengineering program. However, by combining it with genetics, the new GNBT program puts this important discipline in a different context and makes use of existing expertise and ongoing biotechnological research in CNAS. Furthermore, relevant Bioengineering courses are mostly inaccessible to CNAS students due to their prerequisite requirements. To make the distinction between the GNBT and Bioengineering programs clearer to students, we have changed the GNBT program name from Genetics and Biotechnology to Genetics and Molecular Biotechnology.

The Molecular Emphasis track of the Cell, Molecular, and Developmental Biology major is probably the most similar to GNBT. In comparison, GNBT will offer greater breadth and depth in genetics and will uniquely integrate the use of genetics in biotechnology. GNBT will also add new upper-

division laboratory courses, which can be a bottleneck for graduation and are important for students to gain career-relevant, practical, hands-on experiences. [GNBT 114 and GNBT 120 have already been accepted as satisfying a lab requirement for CMDB and ENTM majors in the 2025-26 catalog.](#)

In the future, we envision the development of additional courses such as Synthetic Biology, Statistics for Genetic Analysis, Introduction to Data Science for Biologists, and a Genetic Transformation Laboratory.

4. *The proposed curriculum. Great care should be given in this area, correct rubrics should be listed for courses, all cross listings should be listed, unit total considerations should be taken into account and totals should be verified by program staff, faculty, and appropriate Executive Committee personnel. A copy of the proposed program change should be provided for inclusion in the Catalog.*

### **Major Description**

The B.S. in Genetics and Molecular Biotechnology is designed to prepare UCR undergraduates for careers that involve genetic discovery, interpreting genetic information, and/or using genetic knowledge to create novel solutions to problems facing human health, food production, or the environment. This program emphasizes the development of practical skills for entering the workforce directly after graduation or pursuing postgraduate studies, including training in current laboratory and computational methods for genetic analysis and manipulation, analysis of scientific literature, and critical thinking. After establishing a foundation of basic genetic and biological principles, students may specialize in one of three tracks: Genetics and Genomics, Pre-Genetic Counselings-in Healthcare, or Molecular Biotechnology. The Genetics and Genomics track provides broad training in genetic theories and analysis. The Pre-Genetic Counselings-in Healthcare track has a reduced lab requirement and a greater focus on prerequisites for healthcare-related postgraduate programs such as genetic counseling. The Molecular Biotechnology track offers more opportunities for organism-specific training in preparation for careers in the biomedical, microbial, or plant biotechnology industries.

### **Transfer Students**

Students planning to transfer to UCR with a major in Genetics and Molecular Biotechnology must have a minimum GPA of 2.7 in transferable college courses and “C” or higher grades in a one-year sequence of general chemistry and in courses equivalent to our BIOL 005A and BIOL 005B. We also require that transfer students complete two quarters of college calculus (equivalent to our MATH 007A and 007B or our MATH 009A and MATH 009B) before admission. Exceptions may be granted by the faculty advisor.

**Major Requirements** (see Appendix II for course catalog descriptions)

**Genetics and Genomics, Pre-Genetic Counselings in Healthcare, or Molecular Biotechnology Tracks**

**Core Requirements**

**1. Lower-division requirements (72-73 units)**

Students must complete all required Core Curriculum courses with a grade of C- or better and with a cumulative GPA in the courses of at least 2.0. Grades of D or F in two required courses, either separate courses or repetitions of the same course, are grounds for discontinuation from the major.

- a) BIOL 005A, BIOL 05LA or BIOL 020, BIOL 005B, BIOL 005C
- b) CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC or CHEM 01HA, CHEM 01HB, CHEM 01HC, CHEM 1HLA, CHEM 1HLB, CHEM 1HLC
- c) CHEM 008A, CHEM 008B, CHEM 008C, CHEM 008LA, CHEM 008LB, CHEM 008LC or CHEM 08HA, CHEM 08HB, CHEM 08HC, CHEM 08HLA, CHEM 08HLB, CHEM 08HLC
- d) MATH 007A or MATH 009A or MATH 09HA, MATH 007B or MATH 009B or MATH 09HB
- e) PHYS 002A, PHYS 002B, PHYS 002C, PHYS 02LA, PHYS 02LB, PHYS 02LC or PHYS 02HA, PHYS 02HB, PHYS 02HC, PHYS 02HLA, PHYS 02HLB, PHYS 02HLC or PHYS 040A, PHYS 040B, PHYS 040C or PHYS 040HA, PHYS 040HB, PHYS 040HC
- f) STAT 010
- g) [GNBT 010 \(Genetics and Society\)](#)

**2. Upper-division requirements (24 units)**

- a) BCH 100 or BCH 110A or BCH 110HA
- b) BIOL 102, BIOL 107A or BCH 110C or BCH 110HC, [GNBT 100 \(Biotechnology\)](#), [GNBT 110 \(Advanced Genetics\)](#), [GNBT 114 \(Molecular Genetics Lab\)](#)

**Genetics and Genomics Track**

1. Upper-division requirements (16-20 units)

- a) [GNBT 130 \(Genomes: Structure and Evolution\)](#)
- b) One laboratory course: [GNBT 120 \(Analysis of Genomes\)](#) or BIOL 118 or MCBL 121L/BIOL 121L or 4 units of GNBT 197/199\*
- c) Two or more of the following (8-12 units): BCH 185, BCH 188, BIOL 105, BIOL 107B, BIOL 108, BIOL 115, BIOL 119, BIOL 148/BPSC 148, BPSC 109/CBNS 109, BPSC 150,

BPSC 184/ENTM 184, CBNS 108, CBNS 150/ENTX 150, CBNS 165, ENTM 101, ENTM 111, ENTM 112/BIOL 112/BPSC 112, MCBL 121/BIOL 121, MCBL 139

### **Pre-Genetic Counseling in Healthcare Track**

#### 1. Upper-division requirements (16-20 units)

- a) [GNBT 120 \(Analysis of Genomes\)](#) or [GNBT 130 \(Genomes: Structure and Evolution\)](#) or BIOL 107B or BIOL 119
- b) [One of the following: PSYC 178, PBPL 160, PBPL 167/SOC 167, PBPL 127/SOC 127, or PBPL 162](#)
- c) Two or more of the following (8-12 units): BCH 185, BCH 188, BIOL 107B, BIOL 108, BIOL 115, BIOL 118, BPSC 109/CBNS 109, BPSC 148/BIOL 148, CBNS 108, CBNS 121/PSYC 121, CBNS 150/ENTX 150, CBNS 165, CBNS 169, ENTM 111, ENTM 139/MCBL 139, [GNBT 120, GNBT 130](#), 4 units of GNBT 197/199\*, MCBL 121/BIOL 121, MCBL 123/BIOL 123/PLPA 123, MCBL 124/BIOL 124, MCBL 129

### **Genetic-Molecular Biotechnology Track**

#### 1. Upper-division requirements (16-20 units)

- a) One or two laboratory courses (4-8 units): BPSC 104/BIOL 104, BPSC 143/BIOL 143, [GNBT 120 \(Analysis of Genomes\)](#), 4 units of GNBT 197/199\*, MCBL121L/BIOL121L, PLPA 120/BIOL 120/MCBL 120 and PLPA 120L/BIOL 120L/MCBL 120L
- b) Two or more of the following (8-16 units): BCH 188, BIOL 107B, BIOL 119, BPSC 109/CBNS 109, BPSC 135, BPSC 148/BIOL 148, BPSC 149, BPSC 150, BPSC 183, BPSC 184/ENTX 184, CBNS 108, CBNS 150/ENTX 150, CBNS 165, ENSC 120/NEM 120, ENSC 134/BPSC 134, ENTM 101, ENTM 111, ENTM 125/ENTX 125/PLPA 125, ENTM 126, ENTM 173/BIOL 173, [GNBT 130 \(Genomes: Structure and Evolution\)](#), MCBL 121/BIOL 121, MCBL 123/BIOL 123/PLPA 123, MCBL 126, MCBL 127, MCBL 129, MCBL 133/ENSC 133, MCBL 139/ENTM 139, NEM 159/BIOL 159

\*GNBT 197/199 can be replaced by equivalent research-focused courses (e.g. BIOL 197/199, BPSC 197/199, etc.) with undergraduate advisor approval. Research pursued for credit of GNBT 197/199 or equivalent research-focused courses must serve the training goals of the respective GNBT track.

**Example course schedule with MATH 7A placement**

MATH PLACEMENT: 7A				
	Fall	Winter	Spring	Summer
<b>Year 1</b>	BIOL 5A, LA or 20 (5/6)	BIOL 5B (4) CHEM 1B, 1BL (5)	BIOL 5C (4) CHEM 1C, 1LC (5)	
<b>Total units: 48/49</b>	CHEM 1A, 1LA (5) ENGL 1A (4)	ENGL 1B (4) MATH 7A (4)	ENGL 1C (4) MATH 7B (4)	
Units per Quarter	14/15	17	17	
<b>Year 2</b>	CHEM 8A, 8LA (4) PHYS 2A, 2LA (5)	CHEM 8B, 8LB (4) PHYS 2B, 2LB (5)	CHEM 8C, 8LC (4) PHYS 2C, 2LC (5)	
<b>Total units: 40</b>	SOC 001 (4)	GNBT 010 (4)	STAT 010 (5)	
Units per Quarter	13	13	14	
<b>Year 3</b>	BIOL 102 (4) BCH 100 (4)	BIOL 107A (4) STAT 010 (5)	GNBT 110 (4) GNBT 114 (4)	
<b>Total units: 37</b>	Hum. Breadth (4)	Hum. Breadth (4)	Hum. Breadth (4)	
Units per Quarter	12	13	12	
<b>Year 4</b>	GNBT 100 (4) UD Major Elective (4)	GNBT 120 (4) GNBT 130 (4)	PSYC 178 (4) UD Major Elective (4)	
<b>Total units: 36</b>	Soc. Breadth (4)	UD Major Elective (4)	Elective (4)	
Units per Quarter	12	12	12	
<b>Total units:</b>	<b>161/162</b>			

# Genetics and Molecular Biotechnology (GNBT) Major Requirements

## Lower-division requirements (72-73 units)

general biology (13-14 U): BIOL005A+B+C and BIOL05LA or BIOL020  
general chemistry (15 U): CHEM001A+B+C and CHEM01LA+LB+LC (or honors versions)  
organic chemistry (12 U): CHEM008A+B+C and CHEM08LA+LB+LC (or honors versions)  
calculus (8 U): MATH007A+B or MATH009A+B or MATH09HA+B  
general physics (15 U): PHYS002A+B+C and PHYS02LA+LB+LC (or honors versions, or PHYS40 ABC series w/o labs)  
intro statistics (5 U): STAT010  
**GNBT010 Genetics and Society (4 U)**

## Upper-division requirements (24 units)

BCH100 Introductory Biochemistry (4 U) or BCH110A (or honors) General Biochemistry (4 U)  
BIOL102 Introductory Genetics (4 U)  
BIOL107A Molecular Biology (4 U) or BCH110C (or honors) General Biochemistry (4 U)  
**GNBT100 Biotechnology (4 U)**  
**GNBT110 Advanced Genetics (4 U)**  
**GNBT114 Molecular Genetics Lab (4 U)**

+ 16-20 units from one of the following tracks

### Genetics & Genomics

a) **GNBT130 Genomes: Structure and Evolution (4 U)**

b) One laboratory course (4 units)

**GNBT120 Analysis of Genomes (4 U)**

BIOL118 Methods in Molecular Ecology and Evolution (4 U)

MCBL/BIOL121L Microbiology Laboratory (4 U)

GNBT197/199 Research for Undergraduates (4 U total)

c) Two or more electives (8-12 units)

BCH185 Epigenetics in Development and Disease (4 U)

BCH188 Fundamentals of Genomics Technologies (4 U)

BIOL105 Evolution (4 U)

BIOL107B Advanced Molecular Biology (4 U)

BIOL108 Population Genetics and Genomics (4 U)

BIOL115 Human Genetics (4 U)

BIOL119 Introduction to Genomics and Bioinformatics (4 U)

BIOL/BPSC148 Quantitative Genetics (4 U)

BPSC/CBNS109 Epigenetics (4 U)

BPSC150 Genes, Selection, and Populations (4 U)

BPSC/ENTM184 Planning Postgrad Career in Life Sci (2 U)

CBNS108 Introduction to Developmental Biology (4 U)

CBNS/ENTX150 Cancer Biology (4 U)

CBNS165 Stem Cell Biology (4 U)

ENTM101 Evolution of Insect Genomes

ENTM111 Mol Biol & Genomics of Human Disease Vectors (3 U)

ENTM/BIOL/BPSC112 Systematics (4 U)

ENTM/MCBL139 The Evolution of Conflict and Cooperation (4 U)

MCBL/BIOL121 Introductory Microbiology (4 U)

### Molecular Biotechnology

i) One or two laboratory courses (4-8 units)

BPSC/BIOL104 Foundations of Plant Biology (4 U)

BPSC/BIOL143 Plant Physiology (4 U)

**GNBT120 Analysis of Genomes (4 U)**

MCBL/BIOL121L Microbiology Laboratory (4 U)

GNBT197/199 Research for Undergraduates (4 U total)

PLPA/BIOL/MCBL120+120L Introduction to Plant Pathology with Lab (4 U)

ii) Two or more electives (8-16 units)

BCH188 Fundamentals of Genomics Technologies (3 U)

BIOL107B Advanced Molecular Biology (4 U)

BIOL119 Introduction to Genomics and Bioinformatics (4 U)

BPSC/CBNS109 Epigenetics (4 U)

BPSC135 Plant Cell Biology (4 U)

BPSC/BIOL148 Quantitative Genetics (4 U)

BPSC149 Nanobiotechnology (2 U)

BPSC150 Genes, Selection, and Populations (4 U)

BSPC183 Plant Biochem. & Pharm. of Plant Metabolites (4 U)

BPSC/ENTM184 Planning Postgrad Career in Life Sci (2 U)

CBNS108 Introduction to Developmental Biology (4 U)

### Pre-Genetic Counseling

a) One of

**GNBT120 Analysis of Genomes (4 U)**

**GNBT130 Genomes: Structure and Evolution (4 U)**

BIOL107B Advanced Molecular Biology (4 U)

BIOL119 Introduction to Genomics and Bioinformatics (4 U)

b) PSYC178 Health Psychology (4 U)

c) Two or more electives (8-12 units)

BCH185 Epigenetics in Development and Disease (4 U)

BCH188 Fundamentals of Genomics Technologies (3 U)

BIOL107B Advanced Molecular Biology (4 U)

BIOL108 Population Genetics and Genomics (4 U)

BIOL115 Human Genetics (4 U)

BIOL118 Methods in Molecular Ecology and Evolution (4 U)

BPSC/CBNS109 Epigenetics (4 U)

BPSC/BIOL148 Quantitative Genetics (4 U)

CBNS108 Introduction to Developmental Biology (4)

CBNS/PSYC121 Developmental Neuroscience (4)

CBNS/ENTX150 Cancer Biology (4)

CBNS165 Stem Cell Biology (4)

CBNS169 Human Embryology (4)

ENTM111 Mol Biol & Genomics of Human Disease Vectors (3 U)

ENTM/MCBL139 The Evolution of Conflict and Cooperation (4 U)

**GNBT120 Analysis of Genomes (4 U)**

**GNBT130 Genomes: Structure and Evolution (4 U)**

GNBT197/199 Research for Undergraduates (4 U total)

MCBL/BIOL121 Introductory Microbiology (4 U)

MCBL/BIOL/PLPA123 Introduction to Comparative Virology (4 U)

MCBL/BIOL124 Medical Microbiology (4 U)

MCBL129 Host Responses to Viral Pathogens (4 U)

CBNS/ENTX150 Cancer Biology (4 U)

CBNS165 Stem Cell Biology (4 U)

ENSC/NEM120 Soil Ecology (4 U)

ENSC133 Environmental Microbiology (4 U)

ENSC/BPSC134 Soil Conditions and Plant Growth (4 U)

ENTM101 Evolution of Insect Genomes (4 U)

ENTM111 Mol Biol & Genomics of Human Disease Vectors (3 U)

ENTM/ENTX/PLPA125 Pesticides, Biol Organisms, & the Environment (3 U)

ENTM126 Medical and Veterinary Entomology (4 U)

ENTM/MCBL139 The Evolution of Conflict and Cooperation (4 U)

ENTM/BIOL173 Insect Physiology (4 U)

**GNBT130 Genomes: Structure and Evolution (4 U)**

MCBL/BIOL121 Introductory Microbiology (4 U)

MCBL/BIOL/PLPA123 Introduction to Comparative Virology (4 U)

MCBL126 Microbiomes (3 U)

MCBL127 Microbial Evolution (4 U)

MCBL129 Host Responses to Viral Pathogens (4 U)

MCBL/ENSC133 Environmental Microbiology (4 U)

NEM/BIOL159 Biology of Nematodes (3 U)

5. *A list of faculty who will be involved in the program, including those teaching, advising, and administering.*

**GNBT planning committee**

Daniel Koeing, Botany and Plant Sciences  
Danelle Seymour, Botany and Plant Sciences  
David Nelson, Committee chair, Botany and Plant Sciences  
Dawn Nagel, Botany and Plant Sciences  
Jaime Van Norman, Botany and Plant Sciences  
Sean Cutler, Botany and Plant Sciences  
Susan Wessler, Botany and Plant Sciences  
Thomas Eulgem, Botany and Plant Sciences

**GNBT program participants**

Adam Jozwiak, Botany and Plant Sciences  
Ansel Hsiao, Microbiology and Plant Pathology (primary for BIOL 121)  
Anupama Dahanukar, Molecular, Cell, and Systems Biology  
Carolyn Rasmussen, Botany and Plant Sciences  
Frances Sladek, Molecular, Cell, and Systems Biology  
Hailing Jin, Microbiology and Plant Pathology  
Jason Stajich, Microbiology and Plant Pathology  
Juan Pablo Giraldo, Botany and Plant Sciences  
Julia Bailey-Serres, Botany and Plant Sciences  
Katayoon Dehesh, Botany and Plant Sciences  
Kieran Samuk, EEOB (primary for BIOL108)  
Linda Walling, Botany and Plant Sciences  
Maria Ninova, Biochemistry (primary for BCH188)  
Meng Chen, Botany and Plant Sciences  
Morris Maduro, Molecular, Cell, and Systems Biology  
Nicole zur Neiden, Molecular, Cell, and Systems Biology  
Patricia Springer, Botany and Plant Sciences  
Robert Jinkerson, Chemical and Environmental Engineering  
Sihem Cheloufi, Molecular, Cell, and Systems Biology  
Simon Groen, Assistant Professor, Nematology  
Thomas Girke, Botany and Plant Sciences  
Venugopala Reddy, Botany and Plant Sciences  
Zhenyu (Arthur) Jia, Botany and Plant Sciences  
Kate Ostevik, EEOB (primary for BIOL105)

6. *For interdisciplinary programs, the degree of participation and the role of each department must be explicitly described. The chairs of all participating departments must provide written approval*

*for the creation of the program and indicate their commitment to provide necessary resources including faculty release.*

The Botany and Plant Science department will be responsible for the management of the GNBT major.

7. *Projected enrollment in the program.*

We surveyed other universities offering a degree in Genetics with similarly sized undergraduate student bodies (20,000 to 40,000 students). At these universities enrollment in the major ranged from 200-400 students and the number of enrolled students was proportional to the size of the student body. Based on this information, we expect a class of 240 students at steady state. In the first year that we offer the major, we anticipate an initial enrollment of 30-40. Over time, we expect 60-70 students to join the program annually.

8. *Name of degree, if applicable, and the anticipated number of degrees to be granted when the program reaches steady state.*

Degree name: Bachelor of Science in Genetics and Molecular Biotechnology

Anticipated number of degrees per year: 60

9. *Potential impact of the new program on existing programs. If the proposed program includes required courses from a department other than the administering department, the proposal must include a statement from the department indicating that it has been consulted and that it will provide access to the required courses.*

The pool of potential GNBT undergraduates is expected to primarily overlap with Biology, the largest undergraduate program at UCR. GNBT is unlikely to cause burdensome increases in enrollment in courses from other programs. Instead, GNBT will provide new courses that may be of interest to students in biology-related disciplines, helping to alleviate over-enrollment issues and provide more paths to timely graduation.

Please see Appendix III for letters of support from departments that offer required or elective courses for the GNBT program.

10. *A full listing of resources required for start-up and for operations. In cases where no additional resources will be needed, this must be explicitly stated. This listing may include: personnel (faculty FTE or temporary positions, Teaching Assistants or Readers, administrative staff, technical support); support services including computer facilities and library resources; space requirements. A plan indicating how the resources will be obtained would also be helpful to the committee in reviewing the proposal. A letter of support from the College Dean and/or Executive Vice Chancellor-Provost indicating endorsement as well as a promise of support for the proposal also would be extremely helpful.*

Faculty FTE: We ~~propose to have~~ developed four core courses for the Genetics and Molecular Biotechnology major (GNBT 010, GNBT 100, GNBT 110, and GNBT 114) that are required for degree completion in all three tracks of the major (Genetics and Genomics, Pre-Genetic

Counselings in Healthcare, and Molecular Biotechnology). The three proposed tracks variably require two additional new courses, GNBT 120 and GNBT 130. Initially, each course will be offered one time per year. This will require six faculty members, each of whom will teach one course. Two proposed courses, GNBT 114 and GNBT 120, are laboratory courses. The first laboratory, GNBT 114, will train students in molecular genetic techniques. The second, GNBT 120, is a hands-on introduction to computational biology. The lecture portion of these courses will include up to 48 students, with each laboratory section limited to 24 students. Faculty members, with support from staff and TAs, will lead the laboratory portion of these courses. As the major grows, additional faculty instructors will be needed to increase the offering of these laboratory courses. The enrollment of larger lecture-based courses can scale with the needs of the major, although a maximum of 60-70 students is preferred. GNBT 197/199 are additional options for undergraduate research experiences; students will register for a section specific to their faculty mentor.

TA support: Six of the ~~proposed~~-GNBT courses (not GNBT197/199) include a discussion section and TA support. A total of six TA positions (50%) are needed to support GNBT courses in the first year of the major. If enrollment in a laboratory course exceeds 24 in the first year, then additional TA positions will be needed. Because GNBT 010 is an introductory course that ~~will be accessible to students~~satisfies a breadth requirement from other colleges, it has the potential to attract large enrollment. In its second year (Winter 2026), enrollment for GNBT 010 has already reached its maximum of 80. As it grows, a proportional number of TA positions will be required to assist with teaching discussion sections and grading written assignments.

Administrative staff: A professional undergraduate advisor within the CNAS Undergraduate Academic Advising Center will be needed for GNBT. Faculty undergraduate advisors will be drawn from faculty members affiliated with GNBT. In addition, support from an enrollment management specialist in the CNAS Enrollment Management Center will be needed for scheduling GNBT courses.

Laboratory support: A full-time lab coordinator will be needed for GNBT 114. It is possible that this position could be split with BPSC, such that labs for BPSC and GNBT were jointly coordinated by one individual. In this case, a part-time lab assistant would likely be required. Alternatively, cooperation with Dynamic Genome staff could be explored. Initially, we anticipate two sections of GNBT 114 per year (ideally in one quarter), scaling up to four or six sections as the program increases in size and the course attracts students from related majors (e.g. BIOL, CMDB, CBNS). In terms of physical infrastructure, modern lab spaces will be required that have benches, appropriate safety equipment (e.g. eye wash stations), storage cabinets (for lab items and student personal items), fume hood, sinks, 4°C and -20°C storage, prep space, including nearby autoclaves and sterile work space, and growth space, including incubators for various organisms (plant, microbes, etc). Remodeled, existing BPSC lab spaces can be used in part, but will not be sufficient to support the increased number of lab courses due to this major. Additional equipment needed includes 2 fluorescent stereomicroscopes, 20 compound microscopes and 10 stereoscopes, 24 sets of pipettes (1 per student), gel electrophoresis set ups (6, one per group of 4), gel imaging system, various tube racks (0.2mL, 1.7 mL, 15 mL, etc.), various plastics and glassware (petri plates, etc.), stir plates, pH meter, and thermal cyclers.

Computational lab support: The computational lab, GNBT 120, will require teaching assistant appointments for each section. We anticipate offering one section per year initially, with scaling up to additional sections as necessary in the future. Laboratories should be equipped with one computer per enrolled student. Computers will need to support access to the on-campus High

Performance Computer Cluster (HPCC) and have installed appropriate software including terminal emulation, R, Rstudio, and Python. Computational labs should be accessible outside of class hours.

11. *Both internal and external letters of support should be provided with the proposal. Internal letters of support are often from UCR department chairs and faculty of related programs. The external letters should be from other UC campuses or other peer institutions. Letters from off-campus help to establish the quality of the program and its fit within the context of related programs at other universities. Upon consultation with the CEP the demand for external letters may be waived.*

Please see Appendix III for internal and external letters of support.

12. *Approvals from program faculty, College faculty (if the new proposal affects a college regulation), and the appropriate Executive Committee should be obtained before forwarding the new program to the attention of the Senate Analyst for CEP.*

**APPENDIX I. NEW COURSES (all are approved and currently offered) PROPOSALS**

also called environmental niche modeling or habitat suitability modeling. Addresses biogeographical theories of species niche, data models for species and environmental data, and data analysis and model validation. Applies modern regression (Generalized Linear Models) and other modeling techniques (GAMs, classification trees, MaxEnt) using R software. May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.

#### **BPSC 245 Advanced Plant**

**Ecology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009C or MATH 09HC; STAT 110 or STAT 231A or equivalent; an undergraduate course in ecology; or consent of instructor. Explores the fundamental ecological concepts, theoretical developments, quantitative methods, and experimental results involved in multiscale plant ecological studies. Emphasizes plant strategies, vegetation processes, ecosystem properties, and terrestrial landscapes and their interaction with environmental change and human land use.

**BPSC 246 Landscape Ecology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 116 or BPSC 146; STAT 231A; or consent of instructor. Introduces landscape ecology both as a sub-discipline of ecology and an interdisciplinary approach for environmental research. Includes identification of spatial patterns, pattern-process relationships, and scaling. Analyzes population, community, and ecosystem dynamics in connection with landscape functioning. Evaluates landscape theory and methods for applications in species conservation, pollution, and climate changes.

#### **BPSC 247 Ecological Theory and**

**Modeling 4** Lecture, 2 hours; discussion, 2 hours. Prerequisite(s): MATH 009C or MATH 09HC; STAT 110 or STAT 231B or equivalent; an undergraduate course in ecology; or consent of instructor. Explores the fundamental ecological theory and modeling methodology with emphasis on the ecosystem and landscape levels. Synthesizes current research developments in the context of their classic works.

#### **BPSC 250 Seminar in Plant**

**Biology 1** Seminar, 1 hour. Prerequisite(s): graduate standing or consent of instructor. Intensive study of selected topics in plant biology. Includes lectures by students, faculty, and invited scholars on subjects related to the principles of plant biology. Students who present a seminar receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Course is repeatable.

#### **BPSC 252 Special Topics in Botany/Plant**

**Science 1** Seminar, 1 hour. Prerequisite(s): graduate standing and consent of instructor. Oral presentations and intensive small-group discussion of selected topics in the area of special competence of each staff member. Course content will emphasize recent advances in the special topic area and will vary accordingly. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

#### **BPSC 261 Seminar in Genetics, Genomics, and Bioinformatics 1** Seminar, 1 hour.

Prerequisite(s): graduate standing or consent of instructor. Oral reports by visiting scholars, faculty, and students on current research topics in Genetics, Genomics, and Bioinformatics. Graded Satisfactory (S) or No Credit (NC). Course is repeatable. Cross-listed with BCH 261, BIOL 261, ENTM 261, PLPA 261, and GEN 261.

#### **BPSC 290 Directed Studies 1 to**

**6** Individual Study, 3 to 18 hours.

Prerequisite(s): graduate standing; and consent of instructor. Library, laboratory, or field studies conducted under the direction of a faculty member. Designed to meet specific curricular needs in areas of plant biology not covered by formal course work and outside of required directed dissertation or thesis research. Not intended to replace BPSC 297 or BPSC 299.

#### **BPSC 291 Individual Study in Coordinated**

**Areas 1 to 6** Prerequisite(s): graduate standing. A program of study designed to advise and assist candidates who are preparing for examinations. Up to 6 units may be taken prior to the master's degree. Up to 12 units may be taken prior to advancement to candidacy for the Ph.D. Graded Satisfactory (S) or No Credit (NC). Course is repeatable upon recommendation of the instructor.

#### **BPSC 292 Concurrent and Advanced**

**Studies in Botany and Plant Sciences 1 to 4** Research, 3 to 12 hours. Prerequisite(s): graduate standing; and consent of instructor. Elected concurrently with an appropriate undergraduate course, but on an individual basis. Devoted to one or more graduate projects based on research and criticism related to the course. Faculty guidance and evaluation is provided throughout the quarter.

#### **BPSC 297 Directed Research 1 to**

**6** Research, 3 to 18 hours. Prerequisite(s): graduate standing or consent of instructor. Individual research conducted under the direction of a Botany and Plant Sciences faculty member. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

#### **BPSC 299 Research For Thesis Or**

**Dissertation 1 to 12** Thesis, 3 to 36 hours. Prerequisite(s): graduate standing. Original research in an area selected for the advanced degree. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

## **Genetics and Biotechnology**

### **Lower-Division Courses**

#### **GNBT 010 Genetics and Society 4**

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A is recommended. Explores how genetic discoveries and technology shape human society in healthcare, reproduction, food, and the environment. Presents science concepts at a level accessible to non-majors. Emphasizes bioethical analyses and considers the cost-benefit tradeoffs of genetic advances.

## **Upper-Division Courses**

#### **GNBT 100 Introduction to Biotechnology: From Cloning to Synthetic**

**Biology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102 with a grade of C- or better; or equivalent; or consent of instructor. Introduces fundamental techniques used in biotechnology and the molecular biological foundations of biotechnology. Topics include gene cloning, the science of genetically modified organisms (GMOs), microbial and synthetic biology, the design of new purpose-driven organisms and microbial cell factories, biosensing, gene editing, and other contemporary topics in biotechnology.

#### **GNBT 110 Advanced Genetics 4**

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102 with a grade of C- or better; or consent of instructor. Teaches the process of associating genes with biological function. Topics include genetics screens, gene characterization, and discovery of genetic pathways. Examines the rationale and design of experiments to investigate hypothesis-driven questions using genetic approaches.

#### **GNBT 114 Molecular Genetics**

**Laboratory 4** Lecture, 2 hours; laboratory, 6 hours. Prerequisite(s): BIOL 102 with a grade of C- or better, BIOL 107A, may be taken concurrently. Reinforces important concepts in classical and molecular genetics through laboratory work in basic molecular biology and genetics. Includes DNA manipulation techniques and cloning, gene mapping, and isolation and characterization of mutants in eukaryotic model systems.

#### **GNBT 120 Analysis of Genomes**

**Laboratory 4** Lecture, 1 hour; discussion, 1 hour; laboratory, 6 hours. Prerequisite(s): BIOL 005C with a grade of C- or better, BIOL 102 with a grade of C- or better; MATH 007B or MATH 009B or MATH 09HB with a grade of C- or better. Introduces computational approaches used in analysis of genomes and their functional outputs. Topics include genome assembly and annotation, identification and analysis of genomic sequence variation, modern molecular mutant identification, quantitative trait mapping, genome-wide association mapping, mRNA and small RNA profiling, network analysis, and comparative genomics. Computer programming experience not required.

#### **GNBT 130 Genomes: Structure and**

**Evolution 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102 with a grade of C- or better. Explores the content of genomes from microbes to plants to animals emphasizing how they are analyzed and how they diversify and evolve.

#### **GNBT 197 Research For Undergraduates 1 to 4**

Research, 3 to 12 hours. Prerequisite(s): restricted to class level standing of junior, or senior; and consent of instructor. Individual research conducted under the direction of a Genetics and Biotechnology-affiliated faculty member. A written proposal must be approved by the supervising faculty member and undergraduate advisor. Course is repeatable.

**GNBT 199 Senior Research 2 to 4** Research, 6 to 12 hours. Prerequisite(s): restricted to class level standing of senior; and consent of instructor. Individual research on a problem relating to GNBT program goals. A written proposal signed by the supervising faculty member must be approved by the GNBT undergraduate advisor. Course is repeatable to a maximum of 9 units.



# Business Administration

## Subject abbreviation: BUS The School of Business

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### Professors

Subramanian 'Bala' Balachander, Ph.D.  
*Albert O. Steffey Chair (Marketing)*  
Margaret Campbell, Ph.D. *Associate Dean and Department Chair, and A. Gary Anderson Family Foundation Endowed Presidential Chair (Marketing)*  
Y. Peter Chung, Ph.D. (Finance)  
Elodie Goodman, Ph.D. (Operation and Supply Chain Management)  
Mohsen El-Hafsi, Ph.D. (Operations and Supply Chain Management)  
Jerayr 'John' Halebian, Ph.D. *Associate Dean, and A. Gary Anderson Family Foundation Endowed Presidential Chair in Business Administration (Management)*  
Jean Helwege, Ph.D. *A. Gary Anderson Family Foundation Endowed Presidential Chair in Finance (Finance)*  
Thomas Kramer, Ph.D. *Associate Dean for the Academic Undergraduate Programs (Marketing)*  
Birendra Mishra, Ph.D. (Accounting)  
Theodore Mock, Ph.D. *Distinguished Professor (Accounting)*  
Ashutosh Prasad, Ph.D. (Marketing)  
Yunzeng Wang, Ph.D. *Dean's Distinguished Scholar (Operations and Supply Chain Management)*  
Ivy Zhang, Ph.D. (Accounting and Information System)  
Rami Zwick, Ph.D. *Associate Dean for the Academic Graduate Programs (Marketing)*

### Professors Emeriti

Bajis M. Dodin, Ph.D. (Operations and Supply Chain Management)  
Woody Liao, Ph.D. (Accounting)  
Kathleen Montgomery, Ph.D. *Distinguished Professor (Management)*  
Michael Moore, Ph.D. (Accounting)  
Amnon Rapoport, Ph.D. *Distinguished Professor (Management)*  
Waymond Rodgers, Ph.D. (Accounting and Information Systems)  
Richard Smith, Ph.D. (Finance)  
David Stewart, Ph.D. *Distinguished Professor (Marketing)*

### Associate Professors

Alexander Barinov, Ph.D. (Finance)  
Hai Che, Ph.D. (Marketing)  
Long Gao, Ph.D. (Operations and Supply Chain Management)  
Michael Haselhuhn, Ph.D. (Management)  
Hyun 'Shana' Hong, Ph.D. (Accounting)  
Yawen Jiao, Ph.D. (Finance)  
Boris Maciejovsky, Ph.D. (Management)  
Marlo Raveendran, Ph.D. (Management)  
Ashish Sood, Ph.D. (Marketing)

Danko Turcic, Ph.D. (Operations and Supply Chain Management)

Mindy Truong, Ph.D. (Management)

Elaine Wong, Ph.D. (Management)

### Assistant Professors

Eric Allen, Ph.D. (Accounting)  
Richard Carrizosa, Ph.D. (Accounting)  
Mengmeng Dong, Ph.D. (Finance)  
Mingyu 'Max' Joo, Ph.D. (Marketing)  
Demetrius Lewis, Ph.D. (Management)  
Adem Orsdemir, Ph.D. (Operations and Supply Chain Management)

### Assistant Professor of Teaching

Neman Desai, Ph.D. (Accounting)  
Kyle Ingram, Ph.D. (Management)  
Jonathan Lim, Ph.D. (Marketing)  
Sanjoy Moulik, Ph.D. (Information Systems)  
Greg Richey, Ph.D. (Finance)  
Rich Yueh, Ph.D. (Information Systems)

### Lecturers

Arturo Alcaraz (Management)  
Sean Jasso, Ph.D. (Management and Marketing)  
Jonathan Pittard, M.B.A. (Accounting)  
Raj Singh, Ph.D. (Management)

### Majors

The B.S. in Business Administration is a two-year upper-division major offered by the School of Business. Students can enroll in a Pre-Business status and are advised in CHASS during their freshman and sophomore years. The Pre-Business curriculum includes the prerequisites to the major and the college breadth requirements. After admission to the major, students are advised by the School of Business through its Undergraduate Business Programs Office located at 0241 School of Business Building. The B.S. degree in Business Administration is conferred by the School of Business.

The program is accredited by the AACSB International - The Association to Advance Collegiate Schools of Business.

### Admission

A limited number of students are accepted into the Business Administration major, chosen according to overall GPA. Students must apply for the major when they have completed not fewer than 75 and not more than 100 quarter units of college work. Final acceptance into the major is based on completion of all prerequisites and breadth requirements within a 100-quarter-unit limit, a GPA of 2.50 or above in major prerequisites, and cumulative GPA of at least 2.70. (Students who have not completed the foreign language breadth requirement, ENGL 001C, or one Social Science course of their breadth requirement, may be accepted into the program, but they must complete the requirement before graduation.) Exceptions to the 100-quarter-unit maximum must be requested by petition.

UCR Students (excluding Pre-Business students) interested in changing major to Business Administration will be admissible to the Business Preparatory (BSPR), (which is not a major in UCR, but a holding group of transfer students who appear to be qualified for admission into business administration, but have some deficiencies which need to be completed before admission into business administra-

**Course title**

Genetics and Society (4 units)

**Course catalog description from CRS proposal**

Explores how genetic discoveries and technology are shaping human society on issues ranging from healthcare to reproduction to engineering food and the environment. Science concepts are introduced at a level accessible to non-majors. Emphasizes bioethical analyses and considers the cost-benefit tradeoffs of genetic advances.

**Faculty contact hours**

Lecture - 3 hours per week

**Learning objectives**

- be able to form rational arguments for and against a genetic technology based upon bioethical principles and cost-benefit tradeoffs
- understand how modern genetic technologies work at an introductory level
- understand how emerging genetic technologies are likely to impact human society now and in the coming decades
- be able to think critically about popular science news, identify reliable sources of information, and distinguish hype and opinions from facts

**Grading breakdown**

Homework 60%  
Term paper 20%  
Final exam 20%

**Grading scale**

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	<60%

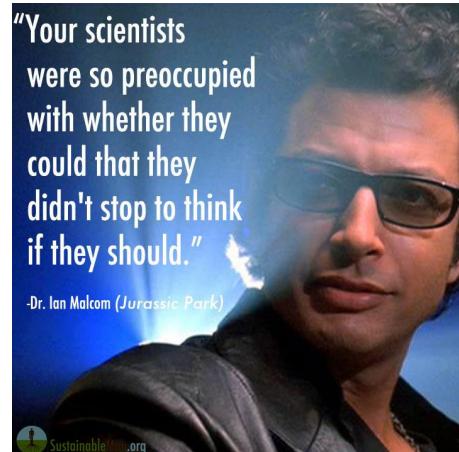
**Description of course activities**

**Lectures (3 hours per week).** Lectures will be partly didactic (introducing students to genetic concepts/technology) and partly socratic (lecturer-led question and answers, e.g. regarding ethical considerations and trade-offs).

**Discussion (1 hour per week).** Discussion sections will allow more small-group activities and student participation in ethical discussions. Difficult biological concepts will be reviewed.

**Reading.** Reading assignments will include popular news articles, case studies, and texts on bioethics. In some cases, videos/film will be used to supplement readings.

**Homework.** Students will provide written answers (typically paragraph-length responses) to a few questions each week intended to provoke reflections on assigned readings and lecture topics. For example, questions may query students' understanding of a genetic technology or topic, or ask them to imagine specific scenarios in which the genetic technology may have a positive or



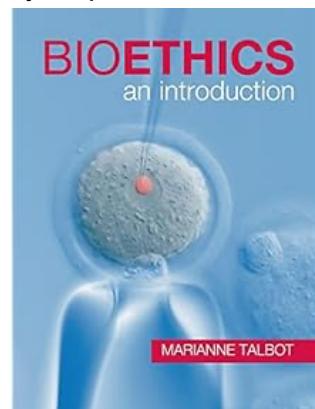
negative outcome, construct and evaluate an ethical argument, or discuss how a specific bioethical principle may be met or violated during the use of a genetic technology.

**Term paper.** Students will identify a recent genetics-related news article and write a 3-page report on it. They will identify the source of the information in the article, assess whether the article is accurately reporting the findings, whether the article appears to be biased or not, discuss the major findings/concepts in the news article and the practical and ethical implications of the genetic discovery/advance.

**Final exam.** The final exam will be held in-person and will emphasize essay responses.

### ***List of required texts and readings***

Talbot, Marianne. (2012). *Bioethics: An Introduction* (1st ed.). Cambridge University Press. ISBN 978-0521714594



### **Course policies**

#### **Conduct**

You are expected to be professional and courteous in your class interactions, whether online or in person. This includes

- avoiding distracting other students from learning
- keeping comments and questions limited to the course subject matter
- being aware that there are a diversity of views, beliefs, backgrounds, and experiences within the class which may not be similar to your own; do your best to be respectful of others
- refraining from intentionally offensive (e.g. sexist, racist, political, etc.) comments or behavior
- maintaining academic integrity
- following campus health guidelines

### **Academic Integrity**

All students are expected to maintain high standards for academic integrity. Students are strongly encouraged to review UCR policies for student conduct and integrity (<https://conduct.ucr.edu/>). If you have any questions, please ask the instructor before you act.

Plagiarism is the most common form of academic misconduct at UCR. It is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit. This includes the copying of language, structure, or ideas of another and attributing (explicitly or implicitly) the work to one's own efforts. Plagiarism means using another's work without giving credit. Note that placing text within quotes and citing it is also not an acceptable substitution for providing original thoughts. For more information about plagiarism, see Academic Integrity Policies and Procedures. While you are encouraged to engage in discussions with other students during homework assignments, submissions for all graded assignments must be your own, original work. ChatGPT and other LLMs are not allowed for the development or revision of rough or final drafts. Plagiarism is a violation of academic integrity and will be handled accordingly. Any suspected cases of cheating, plagiarism, etc. will be forwarded directly to the Office of Student Conduct for their independent review and academic sanctions.

## List of topics and readings by week

	Topic	Reading
<b>Week 1</b>	Introduction to ethical theories	Bioethics Ch. 2-4 (p.11-49) "Ethics in general", "Ethics in the context of society", and "Ethical theories: virtue, duty and happiness"
	Core principles of bioethics: Non-maleficence, justice, autonomy, beneficence, truth telling, and confidentiality	
<b>Week 2</b>	Forming and evaluating ethical arguments	Bioethics Ch. 5-6 (p. 50-90)
	A history of eugenics	National Human Genome Research Institute. "Eugenics: Its Origin and Development (1883 - Present)" <a href="https://www.genome.gov/about-genomics/educational-resources/timelines/eugenics">https://www.genome.gov/about-genomics/educational-resources/timelines/eugenics</a> Bioethics Ch. 9 (p. 139-158 ) "Reproductive freedom: rights, responsibilities, and choice"
<b>Week 3</b>	Genetic determinism and genetic risk	Niccol, Andrew. (1997). "Gattaca". <i>Columbia Pictures</i>
	Genetic testing and genome sequencing technologies	
<b>Week 4</b>	Implications of personalized genetic knowledge	
	Privacy and ownership of genetic information	Seife, Charles. (2013). "23andMe Is Terrifying, but Not for the Reasons the FDA Thinks". <i>Scientific American</i> Bioethics Ch. 18 (p. 348-370), "Bio-ownership: who owns the stuff of life?"
<b>Week 5</b>	Genetic discrimination	Bioethics Ch. 15 (p.273-296), "Bio-information: databases, privacy and the fight against crime"
	Genetics in crime - use as evidence and in recidivism prediction models	
<b>Week 6</b>	Soft eugenics - <i>in vitro</i> fertilization, embryonic selection, prenatal sequencing	Zhang, Sarah. (2020). "The Last Children of Down Syndrome". <i>The Atlantic</i> Bioethics Ch. 11 (p. 181-202) "Screening and embryonic selection: eliminating disorders or people?"
	Changing reproduction - three-parent babies and <i>in vitro</i> gametogenesis	Cohen et al. (2017). "Disruptive reproductive technologies" <i>Science</i> Stein, Rob. (2023). "Creating a sperm or egg from any cell? Reproduction revolution on the horizon". <i>NPR</i> . <a href="https://www.npr.org/sections/health-shots/2023/05/27/1177191913/sperm-or-egg-in-lab-breakthrough-in-reproduction-designer-babies-ivg">https://www.npr.org/sections/health-shots/2023/05/27/1177191913/sperm-or-egg-in-lab-breakthrough-in-reproduction-designer-babies-ivg</a>
<b>Week 7</b>	Genome editing technologies	Bioethics Ch. 14 (p. 251-272), "Human enhancement: the more the better?"
	Gene therapies	
<b>Week 8</b>	Cell replacement therapies	
	Embryonic stem cells and xenotransplantation	Bioethics Ch. 8 (p. 116-136), "Therapeutic cloning: the moral status of embryos"
<b>Week 9</b>	Genetically modified or edited foods	Bioethics Ch. 17 (p. 321-347), "Food and energy security: GM food, biofuel, and the media"
	Gene drives	Bioethics Ch. 21 (p. 418-444), "The living and non-living environment: Spaceship Earth"
<b>Week 10</b>	Organismal cloning	Bioethics Ch. 7 (p. 95-115), "Reproductive cloning science and science fiction"
	De-extinction	Odenbaugh, Jay. (2023). "Philosophy and ethics of de-extinction". Cambridge Prisms: Extinction, 1, e7, 1–7 <a href="https://doi.org/10.1017/ext.2023.4">https://doi.org/10.1017/ext.2023.4</a>

**Course title**

GNBT 100 Introduction to Biotechnology: From Cloning to Synthetic Biology (4 units)

**Faculty contact hours**

Lecture - 3 hours per week

Discussion - 1 hour per week

**Catalog description**

Introduces fundamental techniques used in biotechnology and the molecular biological foundations of biotechnology. Topics include gene cloning, the science of genetically modified organisms (GMOs), microbial and synthetic biology, the design of new purpose-driven organisms and microbial cell factories, biosensing, gene editing, and other contemporary topics in biotechnology.

**Textbook**

*Introduction to Biotechnology (4th ed).* Thieman & Palladino. Pearson.

ISBN-13: 9780137533220

**Prerequisites**

BIOL102

**Grading**

Three Exams	75% (25% each)
Discussion quizzes	15%
Biotech pitches	10%

**Learning objectives**

- *Understand and define biotechnology, its subtypes, and applications.*
- *Define recombinant DNA technology and explain how it is used to clone genes and manipulate DNA.*
- *Diagram and design synthetic DNA constructs for recombinant protein production.*
- *Describe methods for making transgenic plants and mammals.*
- *Describe the impact of biotechnology on agriculture.*
- *Describe the development and importance of Golden Rice.*
- *Explain how to develop a new herbicide-resistant crop*
- *Explain how to develop a new insect-resistant crop*
- *Describe the essential features of CRISPR, gene editing, and design constructs that could be used to edit specific genes.*
- *Understand the purpose of gene therapy, compare and contrast different gene therapy strategies, and recognize the limitations of gene therapy*
- *Define biosensing and design a strategy for creating a new biosensor*
- *Understand the foundations of genome sequencing and chemical DNA synthesis*
- *Explain what a synthetic genome is and how it is constructed.*
- *Identify and define specific problems that can be addressed with biotechnology.*

## Lectures

### Week 1

Lecture 1: What is biotechnology?  
Lecture 2: Recombinant DNA, insulin, the birth of gene-focused biotechnology.  
Reading: Chapters 2 - 3

### Week 2

Lecture 3: Synthetic Biology - design principles & applications  
Lecture 4: Microbes as cell factories: biofuels and chemicals.  
Reading: Chapter 4

### Week 3

#### ***Exam 1***

Lecture 7: Functional and Engineered Foods.  
Reading: Chapter 5

### Week 4

Lecture 8: Genetically modified organisms - foundations & methods (I)  
Reading: Chapter 6

### Week 5

Lecture 9: GMOs - Agricultural Applications (II)  
Reading: Chapter 6, continued

### Week 6

Lecture 10: CRISPR: foundations and biotechnological applications.  
Lecture 11: GMOs in medicine: models & and genetic therapies.  
Reading: Chapter 7, 11

### Week 7:

#### ***Exam 2***

Lecture 12: Designing life: synthetic genomes  
Reading: Chapter 5

### Week 8:

Lecture 13: Bioremediation and environmental biotechnology.  
Lecture 14: Reproductive biotechnology  
Reading: Chapter 9, 11

### Week 9:

Lecture 15: mRNA vaccines & *in vitro* biotechnology  
Lecture 16: Cell-based therapies  
Reading: Chapter 11

**Week 10:**

- Lecture 24: Student Biotechnology Pitches 1
- Lecture 25: Student Biotechnology Pitches 2

***Final exam***

**Course Title: Advanced Genetics**

**Prerequisites:** Introduction to Genetics, BIOL 102

**Faculty Contact Hours: 3 hours (3 hours lecture and 1 hour discussion)/week (4 units)**

**Course Catalog Description:** This course is designed to teach students the process of associating genes with biological function. Topics will include genetics screens, gene characterization, and discovery of genetic pathways. Students will learn the rationale and design of experiments to investigate hypothesis driven questions using genetic approaches.

**Textbook:** Genetic Analysis (Genes, Genomes, and Networks in Eukaryotes). Third Edition Philip Meneely. ISBN: 9780198809906. \$99 (<https://global.oup.com/academic/product/genetic-analysis-9780198809906?cc=us&lang=en&>)

**Student Enrollment:** ~ 40 students.

**Desired Learning Outcomes:**

- 1) Upon completion of this course, students would have gained comprehensive knowledge of the theory and design principle of genetic analysis and approaches.
- 2) Students will become comfortable in reading and analyzing primary literature.
- 3) Understanding the process and logic of genetic investigations.
- 4) Understand how genetic and molecular biology tools are used to understand gene function.
- 5) Understanding how genetic analysis can be used to address the causes of heritable diseases, and diagnostic tool development.

**Grading:**

30% Final Exam (Concept based and paper)

30% Midterm (Concept based and paper)

30% Homework Exercises/Assignment (Related to paper analysis, what is the rationale?, what are the controls?, etc).

10% Discussion Section

**Grading Scale:**

A+: 95-100

A: 90-94

A-: 87-89

B+: 84-86

B: 80-83

B-: 77-79

C+: 74-76

C: 70-73

C-: 67-69  
D+: 64-66  
D: 60-63  
D-: 57-59  
F: 56 and below

### **List of Topics and/or Reading Assignments by Week**

**Week 1** Bootcamp for analysis of scientific literature. Strategies for critical analysis of scientific literature (What are journals? How does peer-review work? How do we recognize what is trustworthy? What are ways to analyze a paper? What should be considered during that process? What are controls? How are experiments performed?).

*Assigned reading: Pain E., How to (seriously) read a scientific paper. 2016 Science (doi: 10.1126/science.caredit.a1600047).*

**Week 2** Lecture on Concepts, identifying and classifying mutants. Assigned paper reading from references taken from the end of the chapter. Chapter 4 (4.1-4.4).

*Assigned reading: Jürgens, G., et al., (1984). Mutations affecting the pattern of the larval cuticle in *Drosophila melanogaster* - II. Zygotic loci on the third chromosome. *Wilhelm Roux's Archives of Developmental Biology*, 193(5), 283-295.*

**Week 3** Lecture on Concepts, identifying and classifying mutants. Chapter 4 cont'd (4.5 - 4.7). Case Study 4.1. Assigned paper reading from references taken from the end of the chapter.

*Assigned reading: Nüsslein-Volhard, C., Wieschaus, E. Mutations affecting segment number and polarity in *Drosophila*. *Nature* 287, 795–801.*

**Week 4** Connecting phenotypes with DNA sequences, Chapter 5.

*Assigned reading: Ng SB, et al., Exome sequencing identifies MLL2 mutations as a cause of Kabuki syndrome. *Nat Genet*. 2010 Sep;42(9):790-3.*

**Week 5** Mutant phenotypes and gene activity, Chapter 6.

*Assigned reading: Gumienny TL, Savage-Dunn C. TGF-β signaling in *C. elegans*. In: WormBook: The Online Review of *C. elegans* Biology [Internet]. Pasadena (CA): WormBook; 2005-2018.*

**Week 6 Midterm 1**, Reverse genetics, Chapter 7.

*Assigned reading: van der Weyden, L., White, J.K., Adams, D.J. et al. The mouse genetics toolkit: revealing function and mechanism. *Genome Biol* 2011 **12**, 224*

**Week 7** Genome editing Chapter 8.

*Assigned reading: Farboud B, Severson AF, Meyer BJ. Strategies for Efficient Genome Editing Using CRISPR-Cas9. Genetics. 2019 Feb;211(2):431-457.*

**Week 8** Genome-wide mutant screens Chapter 9.

*Assigned reading: Walhout AJM. If two deletions don't stop growth, try three. Science. 2018 Apr 20;360(6386):269-270.*

**Week 9** Gene interactions: suppressors and synthetic enhancers Chapter 10.

*Assigned reading: Richards K L et al. 2000. Structure function relationships in yeast tubulins. Molecular Biology of the Cell 11:1887-903*

**Week 10** Epistasis and genetic pathways Chapter 11.

*Assigned reading: Avery, L and S. Wasserman, 1992. Ordering gene function: The interpretation of epistasis in regulatory hierarcgies. Trends in Genetics 8:312-16*

**Description of Course Activities:**

**Lecture (3 hours/week):** One lecture will be focused on genetics concepts related to the assigned chapter study. Second lecture will be focused on the discussion of a case study.

**Reading (4 hours/week):** Reading assigned Chapter from textbook. Read one primary literature article assigned for the case study.

**Homework Exercises/Assignments (1 hour/week):** Relevant to assigned reading of literature. Practical application of paper analysis approaches. For example, draw an experimental set up, analyze a figure to determine the rationale, conclusions and controls, etc.

**Discussion (1 hour/week):** Discuss lecture and experimental design concepts.

**Midterm and Final Exam:** Part based on lecture concepts and part based on case studies. In addition, for the final exam, students will analyze an assigned paper not previously discussed in class.

## **Course title: Molecular Genetics Laboratory**

**Prerequisites:** Prerequisite or concurrent enrollment: BIOL 107A, BIOL 102.

**Faculty contact hours:** 2 hours lecture; 6 hours lab (4 units)

**Student enrollment:** 2 sections (48 per lecture; 24 per lab)

**Course catalog description (50 words):** Reinforce important concepts in classical and molecular genetics through laboratory work in basic molecular biology and genetics including DNA manipulation techniques and cloning, gene mapping, and isolation and characterization of mutants in eukaryotic model systems.

### **Description of course activities:**

Learn to integrate important concepts in classical and molecular genetics into an overall picture of genetic inheritance, the molecular basis of gene function and how gene function can be altered. This course is designed to introduce students to a wide range of molecular biology methods currently in use in both academic and industrial research laboratories. This includes theoretical and practical introduction to molecular biology basics including the properties of plasmids, recombinant DNA techniques, subcloning, bacterial transformation and selection, and the isolation of nucleic acids. Recent advances in biotechnology that have genetic implications and advances in genetic engineering technology will also be introduced. These core competencies in molecular biology will be applied to genetic mapping, mutant identification, and complementation in a eukaryotic system.

Students will learn the basics of experimental design and record keeping, data analysis, and how to present the results in the form of an oral presentation. The course will foster creative, critical thinking, and effective communication skills and prepare students to be contributing members of research labs. The following in-course activities are required: Instruction is based on a combination of lectures (2 hours), direct experimentation (two 3-hour labs). Each lab will begin with a short pre-laboratory quiz to reinforce understanding of key concepts and skills. Students will submit worksheets at the end of each lab period and will prepare one full-length lab report during the quarter. The course will include three in class exams (two midterms and a final).

### **Desired learning outcomes**

1. Develop a basic understanding of inheritance patterns and experimental genetic tools used to isolate genes.

2. Establish a working knowledge of methods in Molecular Biology, including the ability to use standard laboratory equipment and methods frequently used in Molecular Biology research.
3. Practice record keeping and communicating their results in written and oral form.
4. Learn to exercise critical thinking skills to troubleshoot experiments and in the interpretation and reporting of scientific data.

**Grading breakdown:**

- 25% Final exam
- 25% Midterms (2)
- 20% Pre-lab quizzes
- 10% Lab worksheets
- 10% Oral presentation
- 10% Laboratory notebook

**Grading scale:**

A+: 98-100

A: 93-97

A-: 90-92

B+: 87-89

B: 83-86

B-: 80-82

C+: 77-79

C: 73-76

C-: 70-72

D+: 67-69

D: 63-66

D-: 60-62

F: 59 and below

**List of topics and readings by week:**

The lecture topics and laboratory activities for each lecture and lab meeting are detailed in the attached spreadsheet. Each quarter students will perform a series of molecular experiments to introduce basic molecular biology techniques. These experiments will be the same for each course offering and section. In addition, each section will carry out a genetics experiment. Here we have introduced two possible course-long experiments designed using the plant model system *Arabidopsis thaliana*. Similar concepts can be introduced using any eukaryotic model system and this aspect of the course is intended to be flexible to accommodate instructors with expertise in *C. elegans*, *S. cerevisiae*, *D. melanogaster*.

**List of required text and readings:**

Students will be provided with copies of Powerpoint presentations that are part of the lecture. A laboratory manual will be developed to include background information, required reagents, and a step by step guide to each laboratory experiment.

**Description of course activities:**

Lecture: (2 hours/week) Lectures will introduce fundamental concepts related to the molecular and genetics experiments to be performed each week.

Midterm and Final exam: Exams will be based on both lecture material and laboratory experiments. Pre-lab quizzes and lab worksheets will be designed to prepare students for these examinations.

Pre-lab quizzes: During the first 15 minutes of every lab period the students will take a short, 2-3 question quiz. This is meant to reinforce important concepts related to molecular biology techniques and/or genetic experiments introduced during lecture or the previous meeting.

Lab worksheets: Lab worksheets will include exercises to be completed during the current lab period. This will guide students through the completion of the daily molecular and/or genetics experiment. Lab worksheets will also serve to document student attendance and participation.

Lab notebooks: Throughout the course students will maintain a lab notebook. Best practices for record keeping will be introduced early on in the course. Students will update their lab notebook each meeting and include periodic peer evaluations.

Oral presentation: In teams of two, students will present a 12 minute presentation. Presentations will focus on an experiment performed during the course and include the following sections: introduction, materials and methods, and results.

Week/Lab	Lecture topic	Molecular biology experiments	Genetic experiments: <i>Arabidopsis thaliana</i> example	Alternative <i>Arabidopsis thaliana</i> experiments
1.1	Intro to Arabidopsis as a molecular/genetic model system	Intro to Molecular Biology: pipetman use and accurate measurement	Intro into root develop and cell types	Intro to Arabidopsis, root develop and lateral root formation
1.2	Introduction into elements of genetic change in plants: Transposable elements, T-DNA, mutagens, overview of forward and reverse genetic screens	Discuss lab notebooks, purposes and best practices.	Intro into sterile technique laminar flow hood, Plate seeds (e.g. RML/rml1-1 on GSH+ and GSH-media, sensitive/insensitive to exogenous substance)	Intro into sterile technique, Plate various T2 lines on selection media
2.1	Basic molecular biology: Principles and theory of agarose gel electrophoresis; EtBr, markers; analysis of fragment sizes	Intro to Mol. Biol.: dilution, sterile technique for microorgs, plating/streaking bacteria, Mol Exp. 1: Agarose gel electrophoresis.	Introduction to GFP reporters and transgenic plants	Introduction to GFP reporters and transgenic plants
2.2	Restriction enzymes, mapping, plasmid properties (repl origin, selectable markers, polylinker); competent cells and transformation	Examine bacterial plates; Mol Exp 2: Restriction enzymes, plasmid mapping.	Examine segregation ratios for rml1-1 phenotype on GSH+/- plates	Perform selection of T2 lines for various reporters, determine resistant:sensitive ratios
3.1	Subcloning, ligation, directional cloning, blue-white selection	Mol Exp. 3: Transformation of competent cells; Mol Exp. 4: Subcloning- digest vectors and donor DNA	Plate seeds WT, SCR/scr-3 and SHR/shr-2 with pSCR reporter	Plate DR5:GFP, DR5:GFP alf4-1
3.2	Review genetic crosses and segregation ratios (phenotypic vs genotypic). Review subcloning procedures, plasmid properties, transformation	Mol Exp. 3: Count transformation results	Learn to use fluorescence dissecting microscope and take images, Introduce FIJI image analysis tools	Learn to use fluorescence dissecting microscope and take images, Introduce FIJI image analysis tools
4.1	<b>Exam 1</b>	Mol Exp. 4: Subcloning: run gel, cut out and freeze band	Examine segregation ratios for scr and shr plants, examine pSCR reporter expression, image root phenotypes and GFP	Examine LR phenotypes, examine pDR5 reporter expression, image root phenotypes and GFP, excise root tips to examine lateral root
4.2	Subcloning cont.; intro into modern types of cloning (Gateway recombination-based, Golden gate cloning, Gibson assembly, etc.	Mol Exp. 4: Purify fragments, set up ligations	Transplant mutants and WT siblings to soil	Count LRs to assess LR capacity
5.1	Review Meiosis, recombination with respect to crosses	Mol Exp. 4: transform ligations into competent cells (CaCl2, electroporate)	Analyze segregation and GFP image data	Analyze phenotypic and GFP image data
5.2	Principles of nucleic acid isolation; Intro to PCR: Theory and concepts	Review lab notebooks, share and give comments on a classmates lab notebook.	Review experimental procedures, discuss graphical presentation of data and use of statistical tests.	Review experimental procedures, discuss graphical presentation of data and use of statistical tests.
6.1	PCR methods: primers, reaction parameters. Applications: analysis of allelic variation	Mol Exp. 4: Analyze transformation results, start bacterial cultures for plasmid minipreps	Extract plant DNA, PCR for SCR alleles, plate SCR/scr-3 and SHR/shr-2 seeds	Plate DR5:GFP, DR5:GFP alf4-1 on auxin (NAA)
6.2	Review PCR methods and applications; discuss best practices for lab manuals, graphical representation of data and oral presentations.	Mol Exp. 4: Minipreps and restriction digestion of miniprep DNA	Analyze data and label pots with genotypes	Review data and graphical presentations in small groups
7.1	Review: introduction of DNA into plants - review transgenic plants and transposons, introduce enhancer and gene traps	Finish minipreps/digests as needed	Perform shoot and root gravitropism experiments (short term, 2 hours) and image plates and plants turned 6 hours before the lab. (e.g. WT, scr-4, shr)	Examine LR phenotypes, examine pDR5 reporter expression, image root phenotypes and GFP, excise root tips to examine lateral root capacity
7.2	Review Reverse genetics concepts, Intro to targeted mutagenesis: RNAi, CRISPR-Cas9-mediated	Mol Exp. 4: Electrophoresis and analysis of miniprep digests	Analyze gravitropism data	Count LRs to assess LR capacity
8.1	<b>Exam 2</b>	Mol Exp. 4: Continued, Electrophoresis and analysis of miniprep digests	Review data and graphical presentations in small groups	Analyze phenotypic and GFP image data
8.2	Introduce DNA repair mechanisms, homologous recombination in plants, why do difficult?	Mol Exp. 5: PCR amplification of human cheek cell DNA	Finalize lab notebook entries	Finalize lab notebook entries
9.1	Molecular mapping of transposon and T-DNA insertions; - inverse PCR ; Blast searches of sequence databases.	(TA runs class gel to analyze human cheek cell PCR results), Mol Exp. 5: Analyze human DNA PCR results;	Peer evaluations of two lab notebook entries	Peer evaluations of two lab notebook entries
9.2	Prepare for presentations		Presentations on lab topic of choice	Presentations on lab topic of choice
10.1	Prepare for presentations		Presentations on lab topic of choice	Presentations on lab topic of choice
10.2	<b>Exam 3/Final</b>		<b>Submit updated lab notebooks</b>	<b>Submit updated lab notebooks</b>
			*course can be adapted to use other organisms based on instructor's preference (e.g. <i>Drosophila melanogaster</i> , <i>Caenorhabditis elegans</i> )	

**GNBT120: Analysis of Genomes Laboratory**

Credit Hours: 4

Faculty contact hours: 1 hour lecture, 1 hour discussion, 6 hours laboratory

**Prerequisite(s):**

BIOL 005C with a grade of C- or better; BIOL 102; MATH 007B or MATH 009B or MATH 09HB.

**Example course times:**

Lecture + Lab: TR 1:00-4:50 PM

Discussion: F 1:00-1:50 PM

**Course Catalog description:**

Introduces the key computational approaches used in the analysis of genomes and their functional outputs. Topics include genome assembly and annotation, identification and analysis of genomic sequence variation, modern molecular mutant identification, quantitative trait mapping, genome-wide association mapping, mRNA and small RNA profiling, network analysis, and comparative genomics. Computer programming experience is not required.

**Learning Objectives:**

1. Develop an understanding of how genomics data is stored and manipulated in modern computing environments.
2. Gain experience analyzing data and recording results using the tools of computational biology.
3. Perform several of the common analyses used to understand genomes.

**Grading breakdown:**

Lab Assignments: 45%

Take Home Midterm: 25%

Take Home Final: 25%

Lecture Quizzes and Class participation: 5%

**Course activities:**

A series of topic videos will be made ahead of the course meeting, and the beginning of each meeting will be used to discuss the contents of the readings and the course videos. The remainder of the time will be devoted to working through the laboratory material. Graded material includes:

- 1) Weekly assignments which will include questions about the laboratory content that you can fill in as you work through the material.
- 2) Short quizzes that will cover the lecture material specifically.
- 3) A midterm and final exam, both of which will test your knowledge of the course material by requiring you to complete a series of related tasks.

**Texts (Both O'Reilly and available for free for UC students):**

Bioinformatics Data Skills, Vince Buffalo

R for Data Science, Hadley Wickham

Selected methods primers

**Grading scale:**

A+: 98-100

A: 93-97

A-: 90-92

B+: 87-89

B: 83-86

B-: 80-82

C+: 77-79

C: 73-76

C-: 70-72

D+: 67-69

D: 63-66

D-: 60-62

F: 59 and below

**Enrollment:**

25 students / lab

**Example Schedule:**

Week	Day	Topic	Reading
1	T	JetStream; Markdown; Intro Linux	Buffalo: p. 1 - 54 (Chapters 1-3)
1	R	Intro Linux Continued; Git	Buffalo: p. 67 - 97 (Chapter 5); 125 - 165 (Chapter 7)
1	F	Discussion: Linux, Git	
2	T	For Loops; BLAST I	Chapter 6 of Bioinformatics for Beginners
2	R	BLAST II	
2	F	Discussion: For loops, BLAST	
3	T	R: Intro	Buffalo: p. 175 - 206 (Start of Chapter 8 to Exploring Data)

			Visually with ggplot2 1: Scatterplots and Densities); R for data science Chapters 27, 4
3	R	R: Tidyverse	R for data science Chapters 5, 6, 10, 18
3	F	Discussion: R	
4	T	Multiple Sequence Alignment and Tree Building	Chapter 9 of Bioinformatics for Beginners
4	R	R SNPs; ggplot	Buffalo: p. 207 - 224 (Chapter 8 Exploring Data Visually with ggplot2 1: Scatterplots and Densities to Using ggplot2 Facets); R for data science Chapters 3, 12
4	F	Discussion: Tidyverse, trees, etc	
5	T	GWAS	Genome-wide association studies Uffelmann et al.
5	R	Work on midterm	
5	F	Discussion: QTLs and GWAS	
6	T	Shiny Midterm Due @ 1:10	
6	R	Illumina Sequence Data: QC and mapping	Buffalo: p. 339 - 351 (Start of Chapter 10 to Indexed FASTA Files) Wikipedia FastQ U Mich SAM wiki
6	F	Discussion: Sequencing methods	
7	T	Illumina: SNPs and IGV	Buffalo p. 355 - 377 (Start of Chapter 11 to Pileups with samtools pileup)

7	R	Illumina: RNAseq	RNA Sequencing Data: Hitchhiker's Guide to Expression Analysis (up to single cell sequencing)
7	F	Discussion: Genetic variation	
8	T	Illumina: RNAseq	RNA Sequencing Data: Hitchhiker's Guide to Expression Analysis (remainder)
8	R	Motif discovery	How does DNA sequence motif discovery work? And What are DNA sequence motifs? D'haeseleer 2006
8	F	Discussion: Transcriptional Regulation I	
9	T	Clustering	Ospina et al. A Primer on Preprocessing, Visualization, Clustering, and Phenotyping of Barcode-Based Spatial Transcriptomics Data
9	R	Networks	Modeling and analysis of gene regulatory networks Karlebach 2008
9	F	Discussion: Transcriptional Regulation II	
10	T	Metagenomics	A Primer on Metagenomics Wooley et al. 2010
10	R	Metagenomics	
10	F	Discussion: Metagenomics	

**Course title**

GNBT 130: Genomes: Structure and Evolution

**Course catalog description**

Explores the content of genomes from microbes to plants to animals with emphasis on how they are analyzed and how they diversify and evolve.

**Prerequisites**

BIOL102

**Faculty contact hours**

Lecture – 3 hours per week

**Learning Objectives**

1. Develop a basic understanding of genome components and how they can differ among and between species.
2. Understand the technological advances central to genome analyses
3. Understand why transposable element content can greatly exceed gene content in eukaryotic genomes.
4. be able to think critically about how genomes have evolved complexity and mechanisms that diversify genes and fuel natural selection.
5. Understand how prokaryotes and eukaryotes protect the integrity of their genomes

**Grading breakdown:**

50% Discussion participation

30% Final exam

20% Class presentation

**Grading scale:**

A 90-100%

B 80-89%

C 70-79%

D 60-69%

F <60%

**Description of course activities**

**Lectures** (3 hours per week). Lectures will be partly didactic (reviewing concepts that students will encounter in the assigned readings) and partly student presentations of the papers.

**Discussion** (1 hour per week).

**Reading**. Reading assignments will be largely from the current literature including both primary research and review journal articles.

**Homework**. In advance of reading assignments, students will be given a list of questions – designed to test their understanding of concepts and provoke original thought. Questions will form the basis for in-class discussion. In addition, students present short background summaries of the paper(s) assigned for that week.

**In class presentation (once/student)**. Students will select one of the weekly assigned papers and prepare a 15 min background presentation to be coordinated with the instructor.

**Final exam.** The final exam will be held in-person and will emphasize a holistic understanding of the genomes of life.

### ***Course policies***

#### **Conduct**

You are expected to be professional and courteous in your class interactions, whether online or in person. This includes:

- avoiding distracting other students from learning
- keeping comments and questions limited to the course subject matter
- being aware that there are a diversity of views, beliefs, backgrounds, and experiences within the class which may not be like your own; do your best to be respectful of others
- refraining from intentionally offensive (e.g. sexist, racist, political, etc.) comments or behavior
- maintaining academic integrity
- following campus health guidelines

#### **Academic Integrity**

All students are expected to maintain high standards for academic integrity. Students are strongly encouraged to review UCR policies for student conduct and integrity (<https://conduct.ucr.edu/>). If you have any questions, please ask the instructor before you act.

Plagiarism is the most common form of academic misconduct at UCR. It is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit. This includes the copying of language, structure, or ideas of another and attributing (explicitly or implicitly) the work to one's own efforts. Plagiarism means using another's work without giving credit. Note that placing text within quotes and citing it is also not an acceptable substitution for providing original thoughts. For more information about plagiarism, see Academic Integrity Policies and Procedures. While you are encouraged to engage in discussions with other students during homework assignments, submissions for all graded assignments must be your own, original work. ChatGPT and other LLMs are not allowed for the development or revision of rough or final drafts. Plagiarism is a violation of academic integrity and will be handled accordingly. Any suspected cases of cheating, plagiarism, etc. will be forwarded directly to the Office of Student Conduct for their independent review and academic sanctions.

	Topic	Reading (to be selected from recent, current literature)
Weeks 1 & 2	Genomes overview: historical landmarks, parts list (TEs, non-coding)	(1) Girardini, KN, Olthof, AM, Kanadia, RN (2023) Introns: the dark matter of eukaryotic genomes. <i>Front Genet</i> 14: 1150212. (2) Hayward, A., Gilbert C (2022) Primer: transposable elements. <i>Curr Biol</i> . 32: R897-R911.
Week 3	Phage and other viral genomes	(1) Guzman-Solis, AA. et al (2023) A glimpse into the past: what ancient viral genomes reveal about human history. <i>Ann Rev Virol</i> . 10: 49-75. (2) Caetano-Anolles, G., Claverie, J-M, Nasir, A. (2023) A critical analysis of the current state of virus taxonomy. <i>Front in Micro</i> 14: 1240993.
Week 4	Bacterial Genomes	(1) Kirchberger PC, Schmidt, Ochman (2020) The ingenuity of bacterial genomes. <i>Ann Rev Micro</i> 74: 815-834.

		(2) Mayo-Munoz, D. et al (2023) A host of armor: Prokaryotic immune strategies against mobile genetic elements. <i>Cell Reports</i> . 42: July.
Week 5	Fungal Genomes	(1) Gryganskyi, AP et al (2023) Sequencing the genomes of the first terrestrial fungal lineages: what have we learned? <i>Microorganisms</i> 11:1830. (2) Zande, PV, Zhou, X., Selmecki, A. (2023) The dynamic fungal genome: polyploidy, aneuploidy and copy number variation in response to stress. <i>Ann Rev Micro</i> 77:341-361.
Week 6	Insect Genomes	(1) Rech, GE, et al (2022) Population-scale long-read sequencing uncovers transposable elements associated with gene expression variation and adaptive signatures in <i>Drosophila</i> . <i>Nat Comm</i> ( <a href="https://doi.org/10.1038/s41467-022-29518-8">https://doi.org/10.1038/s41467-022-29518-8</a> ) (2) San Jose, M., Dorenweerd, C., Rubinoff, D. (2023) Genomics reveals widespread hybridization across insects. <i>Curr Opin Insect Sci</i> . 58: 101052
Week 7	Plant Genomes	(1) Sun, Y et al (2022) Twenty years of plant genome sequencing: achievements and challenges. <i>Trends Plt Sci</i> . ( <a href="https://doi.org/10.1016/j.tplants.2021.10.006">https://doi.org/10.1016/j.tplants.2021.10.006</a> ) (2) Liu, P. et al (2022) The epigenetic control of the transposable element life cycle in plant genomes and beyond. <i>Ann Rev Genet</i> 56: 63-87.
Week 8	Mammalian/Human Genomes	(1) Garg, KM et al (2023) Next generation sequencing revolutionizes organismal biology in bats. <i>Jour. Evol Biol</i> 91: 391-404 (2) Wang, J, Lu, X, Zhang, W, Liu G-H (2023) Endogenous retroviruses in development and health. <i>Trends Micro</i> . ( <a href="https://doi.org/10.1016/j.tim.2023.09.006">https://doi.org/10.1016/j.tim.2023.09.006</a> )
Week 9	Polyploid Genomes	(1) Mason, AS, Wendel, JF (2020) Homoeologous exchanges, segmental allopolyploidy, and polyploid genome evolution. <i>Front. Genet</i> . 11: 1014. (2) Sanz-Gomez, N. et al (2023) Whole genome doubling as a source of cancer: how, when, where, and why? <i>Front. Cell Dev Biol</i> . 11:1209136.
Week 10	Future directions	(1) Escudeiro, P, Henry CS, Dias RPM (2022) Functional characterization of prokaryotic dark matter. <i>Curr Res Microb Sci</i> 3. 100159 (2) Yadav, D. et al (2023) Next-generation sequencing transforming clinical practice and precision medicine. <i>Clin.Chim.Acta</i> . Oct 13:117568.

## APPENDIX II. COURSE CATALOG DESCRIPTIONS

### 1. Lower-division requirements

**BIOL 005A Introduction to Cell and Molecular Biology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 05LA with a grade of C- or better, may be taken concurrently or BIOL 020 with a grade of C- or better, may be taken concurrently; CHEM 001A with a grade of C- or better, may be taken concurrently, CHEM 01LA with a grade of C- or better, may be taken concurrently or CHEM 01HA with a grade of C- or better, may be taken concurrently, CHEM 1HLA with a grade of C- or better, may be taken concurrently or CHEM 002A with a grade of C- or better, may be taken concurrently, CHEM 02LA with a grade of C- or better, may be taken concurrently. [An intensive course designed to prepare for upper-division courses in cell and molecular biology. Covers biochemical, structural, metabolic, and genetic aspects of cells.](#) Required for Biology majors; recommended for science majors desiring an introduction to biology.

**BIOL 005B Introduction to Organismal Biology 4** Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A with a grade of C- or better; BIOL 05LA with a grade of C- or better or BIOL 020 with a grade of C- or better; CHEM 001A, CHEM 01LA or CHEM 01HA, CHEM 1HLA or CHEM 002A, CHEM 02LA; CHEM 001B, may be taken concurrently, CHEM 01LB, may be taken concurrently or CHEM 01HB, may be taken concurrently, CHEM 1HLB, may be taken concurrently or CHEM 002B, may be taken concurrently, CHEM 02LB, may be taken concurrently. [An intensive course designed to prepare for upper-division courses in organismal biology. Covers developmental biology, physiology, and regulation at the level of the organism.](#) Required for Biology majors; recommended for science majors desiring an introduction to biology.

**BIOL 005C Introductory Evolution and Ecology 4** Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A with a grade of C- or better; BIOL 05LA with a grade of C- or better or BIOL 020 with a grade of C- or better; BIOL 005B with a grade of C- or better; MATH 009A with a grade of C- or better or MATH 09HA with a grade of C- or better or MATH 007A with a grade of C- or better; CHEM 001C, may be taken concurrently, CHEM 01LC, may be taken concurrently or CHEM 01HC, may be taken concurrently, CHEM 1HLC, may be taken concurrently or CHEM 002C, may be taken concurrently, CHEM 02LC, may be taken concurrently. [An intensive introduction to the subjects of evolution and ecology. Covers population dynamics, community ecology, population genetics, and evolutionary theory.](#) Recommended for science majors desiring an introduction to biology. Students who take equivalent first-year biology at another institution may enter directly into BIOL 005C without critical handicap.

**BIOL 05LA Introduction to Cell and Molecular Biology Laboratory 1** Laboratory, 3 hours. Prerequisite(s): BIOL 005A (may be taken concurrently); consent of instructor is required for students repeating the course. [An introduction to laboratory exercises on fundamental principles of and techniques in cell and molecular biology. Illustrates the experimental foundations of the topics covered in BIOL 005A.](#) Credit is not awarded for BIOL 05LA if it has already been awarded for BIOL 020.

**BIOL 020 Dynamic Genome 2** Laboratory, 6 hours. Prerequisite(s): CHEM 001A with a grade of C- or better, may be taken concurrently, CHEM 01LA with a grade of C- or better, may be taken concurrently or CHEM 01HA with a grade of C- or better, may be taken concurrently, CHEM 1HLA with a grade of C- or better, may be taken concurrently or CHEM 002A with a grade of C- or better, may be taken concurrently, CHEM 02LA with a grade of C- or better, may be taken concurrently; MATH 009A, may be taken concurrently or MATH 09HA, may be taken concurrently or MATH 007A, may be taken concurrently; restricted to class level standing of freshman. [Introduces computational and experimental approaches in investigating the genomes of plants and animals. Explores scientific discovery using the tools of bioinfor-](#)

matics and genomics. Includes participation in research projects being conducted on campus. Credit is awarded for one of the following BIOL 020 or BIOL 05LA.

**CHEM 001A General Chemistry 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LA; MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or CHEM 001W with a grade of S or better or CHEM 001 with a grade of S or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 009C with a grade of C- or better; or a score of 3, 4, or 5 on the College Board Advanced Placement Chemistry Examination or Advanced Placement Calculus Examination or a passing score on the California Chemistry Diagnostic Test or a score on the Mathematics Advisory Exam sufficient for placement in MATH 007A or MATH 009A. [An introduction to the basic principles of chemistry](#). Instructional methods are either in-person lectures or virtual online lectures. Credit is awarded for one of the following CHEM 001A, CHEM 002A, or CHEM 01HA.

**CHEM 001B General Chemistry 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LB; CHEM 001A with a grade of C- or better, CHEM 01LA with a grade of C- or better or CHEM 01HA with a grade of C- or better, CHEM 1HLA with a grade of C- or better or CHEM 002A with a grade of C- or better, CHEM 02LA with a grade of C- or better. [An introduction to the basic principles of chemistry](#). Provides lectures either in person or in a virtual online environment, depending on section offerings. Credit is awarded for one of the following CHEM 001B, CHEM 002B, or CHEM 01HB.

**CHEM 001C General Chemistry 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LC; CHEM 001B with a grade of C- or better or CHEM 01HB with a grade of C- or better; CHEM 01LB with a grade of C- or better or CHEM 1HLB with a grade of C- or better or CHEM 002B with a grade of C- or better, CHEM 02LB with a grade of C- or better. [An introduction to the basic principles of chemistry](#). Provides lectures either in person or in a virtual online environment, depending on section offerings. Credit is awarded for one of the following CHEM 001C, CHEM 002C, or CHEM 01HC.

**CHEM 01LA General Chemistry Laboratory 1** Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001A; MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or CHEM 001W with a grade of S or better or CHEM 001 with a grade of S or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 009C with a grade of C- or better; or a score of 3, 4, or 5 on the College Board Advanced Placement Chemistry Examination or Advanced Placement Calculus Examination or a passing score on the California Chemistry Diagnostic Test or a score on the Mathematics Advisory Exam sufficient for placement in MATH 007A or MATH 009A. [An introduction to laboratory principles and techniques related to lecture topics in CHEM 001A](#). Credit is awarded for one of the following CHEM 01LA, CHEM 02LA, or CHEM 1HLA.

**CHEM 01LB General Chemistry Laboratory 1** Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001B; CHEM 001A with a grade of C- or better or CHEM 01HA with a grade of C- or better or CHEM 01LA with a grade of C- or better or CHEM 1HLA with a grade of C- or better or CHEM 002A with a grade of C- or better or CHEM 02LA with a grade of C- or better. [An introduction to laboratory principles and techniques related to lecture topics in CHEM 001B](#). Credit is awarded for one of the following CHEM 01LB, CHEM 02LB, or CHEM 1HLB.

**CHEM 01LC General Chemistry Laboratory 1** Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001C; CHEM 001B with a grade of C- or better or CHEM 01HB with a grade of C- or better or

CHEM 002B; CHEM 01LB or CHEM 1HLB or CHEM 02LB. An introduction to laboratory principles and techniques related to lecture topics in CHEM 001C. Credit is awarded for one of the following CHEM 01LC, CHEM 02LC, or CHEM 1HLC.

**CHEM 008A Organic Chemistry 3** Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LA; CHEM 001C with a grade of C- or better, CHEM 01LC with a grade of C- or better or CHEM 01HC with a grade of C- or better, CHEM 1HLC with a grade of C- or better or CHEM 002C with a grade of C- or better, CHEM 02LC with a grade of C- or better. **Covers modern organic chemistry including hydrocarbon structure and nomenclature, stereochemistry, and reaction mechanisms.** Provides lectures either in person or in a virtual online environment, depending on section offerings. Credit is awarded for one of the following CHEM 008A or CHEM 08HA.

**CHEM 008B Organic Chemistry 3** Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LB; CHEM 008A with a grade of C- or better, CHEM 08LA with a grade of C- or better or CHEM 08HA with a grade of C- or better, CHEM 08HLA with a grade of C- or better. **Covers modern organic chemistry including structural determination via spectroscopic analysis, reactivity, reaction mechanisms, and multistep organic synthesis.** Credit is awarded for one of the following CHEM 008B or CHEM 08HB.

**CHEM 008C Organic Chemistry 3** Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LC; CHEM 008B with a grade of C- or better, CHEM 08LB with a grade of C- or better or CHEM 08HB with a grade of C- or better, CHEM 08HLB with a grade of C- or better. **Covers modern organic chemistry and chemical biology including reactivity and synthesis. Also includes reaction mechanisms and the chemistry of carbohydrates, lipids, nucleic acids, amino acids, and proteins.** Credit is awarded for one of the following CHEM 008C or CHEM 08HC.

**CHEM 08LA Organic Chemistry Laboratory 1** Laboratory, 4 hours. Prerequisite(s): concurrent enrollment in CHEM 008A; CHEM 001C with a grade of C- or better, CHEM 01LC with a grade of C- or better or CHEM 01HC with a grade of C- or better, CHEM 1HLC with a grade of C- or better or CHEM 002C with a grade of C- or better, CHEM 02LC with a grade of C- or better. **An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis.** Credit is awarded for one of the following CHEM 08LA or CHEM 08HLA.

**CHEM 08LB Organic Chemistry Laboratory 1** Laboratory, 4 hours. Prerequisite(s): CHEM 008A and CHEM 08LA or CHEM 08HA and CHEM 08HLA with grades of "C-" or better; concurrent enrollment in CHEM 008B or a grade of "C-" or better in CHEM 008B. **An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis.** Credit is awarded for only one of CHEM 08LB or CHEM 08HLB.

**CHEM 08LC Organic Chemistry Laboratory 1** Laboratory, 4 hours. Prerequisite(s): CHEM 008B and CHEM 08LB or CHEM 08HB and CHEM 08HLB with grades of "C-" or better; concurrent enrollment in CHEM 008C or a grade of "C-" or better in CHEM 008C. **An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis.** Credit is awarded for only one of CHEM 08LC or CHEM 08HLC.

**GNBT 010 Genetics and Society 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): none; BIOL 005A recommended. **Explores how genetic discoveries and technology are shaping human society on issues ranging from healthcare to reproduction to engineering food and the environment.** Science concepts are

introduced at a level accessible to non-majors. Emphasizes bioethical analyses and considers the cost-benefit tradeoffs of genetic advances.

**MATH 007A Calculus For Life Sciences 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 005A or MATH 006B. [Introduction to the differential calculus of functions of one variable for students majoring in Life Sciences](#). Credit is awarded for one of the following MATH 007A, MATH 005B, MATH 009A, or MATH 09HA.

**MATH 007B Calculus For Life Sciences 4** Discussion, 1 hour; lecture, 3 hours. Prerequisite(s): MATH 007A with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 09HA with a grade of C- or better. [Introduction to the integral calculus of functions of one variable. For Life Sciences majors](#). Credit is awarded for one of the following MATH 007B, MATH 005C, MATH 009B, or MATH 09HB.

**MATH 009A First-Year Calculus 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 005A with a grade of C- or better or MATH 006B. [Introduction to the differential calculus of functions of one variable](#). Credit is awarded for one of the following MATH 009A, MATH 005B, MATH 007A, or MATH 09HA.

**MATH 009B First Year Calculus 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 005B with a grade of C- or better or MATH 009A or MATH 09HA. [Introduction to the integral calculus of functions of one variable](#). Credit is awarded for one of the following MATH 009B, MATH 005C, MATH 007B, or MATH 09HB.

**MATH 09HA First-Year Honors Calculus 4** Discussion, 1 hour; lecture, 3 hours. Prerequisite(s): admission to University Honors. Honors course corresponding to MATH 009A. [Honors course corresponding to MATH 009A for students with strong mathematical backgrounds. Introduces the differential calculus of functions of one variable. Emphasis is on theory and rigor](#) Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following MATH 09HA, MATH 005B, MATH 007A, or MATH 009A.

**MATH 09HB First-Year Honors Calculus 4** Discussion, 1 hour; lecture, 3 hours. Prerequisite(s): MATH 09HA with a grade of B or better; admission to University Honors. Honors course corresponding to MATH 009B. [Honors course corresponding to MATH 009B for students with strong mathematical backgrounds. Introduces the integral calculus of functions of one variable. Emphasis is on theory and rigor](#). Credit is awarded for one of the following MATH 09HB, MATH 005C, MATH 007B, or MATH 009B.

**PHYS 002A General Physics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in PHYS 02LA; MATH 007A with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 09HA with a grade of C- or better. [Covers topics in classical mechanics including Newton's laws of motion in one and two dimensions; work, energy, and conservation of energy; momentum and collisions; rotational motion; and orbital motion. For biological sciences students](#). Credit is awarded for one of the following PHYS 002A, PHYS 02HA, PHYS 040A, or PHYS 040HA.

**PHYS 002B General Physics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 007B or MATH 009B or MATH 09HB (may be taken concurrently); PHYS 002A or PHYS 02HA with a grade of "C-" or better; concurrent enrollment in PHYS 02LB or a grade of "C-" or better in PHYS 02LB is required. [Covers topics in mechanics, thermodynamics, and electromagnetism. Includes fluid mechanics; temperature and heat; the laws of thermodynamics; kinetic theory of gases; electric fields and potentials; current and DC circuits; capacitance and inductance; magnetism; and Faraday's law. For biological sciences students](#).

Credit is not awarded for PHYS 002B if it has already been awarded for PHYS 02HB; PHYS 040B or PHYS 040HB and PHYS 040C or PHYS 040HC; or PHYS 041B.

**PHYS 002C General Physics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PHYS 002B or PHYS 02HB with a grade of "C-" or better; concurrent enrollment in PHYS 02LC or a grade of "C-" or better in PHYS 02LC. **Covers topics in waves and modern physics. Includes harmonic oscillations; mechanical and electromagnetic waves; geometrical optics; reflection, refraction, interference, diffraction, and polarization; and quantum, atomic, and nuclear physics. For biological sciences students.** Credit is not awarded for PHYS 002C; if it has already been awarded for PHYS 02HC; or PHYS 041C.

**PHYS 02LA General Physics Laboratory 1** Laboratory, 3 hours. Prerequisite(s): concurrent enrollment or a grade of "C-" or better in PHYS 002A or PHYS 02HA. **Illustrates the experimental foundations of physics presented in PHYS 002A. Covers the basic principles of classical mechanics.** Credit awarded for only PHYS 02LA or PHYS 02HLA.

**PHYS 02LB General Physics Laboratory 1** Laboratory, 3 hours. Prerequisite(s): PHYS 002A and PHYS 02LA or PHYS 02HA and PHYS 02HLA with grades of "C-" or better; concurrent enrollment or a grade of "C-" or better in PHYS 002B or PHYS 02HB. **Illustrates the experimental foundations of physics presented in PHYS 002B. Covers the basic principles of fluid and rotational mechanics, temperature, heat, and electromagnetism.** Credit is awarded for only one of PHYS 02LB or PHYS 02HLB.

**PHYS 02LC General Physics Laboratory 1** Laboratory, 3 hours. Prerequisite(s): PHYS 002B and PHYS 02LB or PHYS 02HB and PHYS 02HLB with a grade of "C-" or better; concurrent enrollment or a grade of "C-" or better in PHYS 002C or PHYS 02HC. **Illustrates the experimental foundations of physics presented in PHYS 002C. Covers the basic principles of oscillations, waves, optics, and radioactivity.** Credit is awarded for only one of PHYS 02LC or PHYS 02HLC.

**PHYS 040A General Physics 5** Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): MATH 007A or MATH 009A or MATH 09HA with a grade of "C-" or better; MATH 007B or MATH 009B or MATH 09HB with a grade of "C-" or better (MATH 009B or MATH 09HB may be taken concurrently). **Designed for engineering and physical sciences students. Covers topics in classical mechanics including Newton's laws of motion; friction; circular motion; work, energy, and conservation of energy; dynamics of particle systems; collisions; rigid-body motion; torque; and angular momentum. Laboratories provide exercises illustrating experimental foundations of physical principles and selected applications.** Credit is not awarded for PHYS 040A if it has already been awarded for PHYS 002A, PHYS 02HA, PHYS 040HA, or PHYS 041A.

**PHYS 040B General Physics 5** Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): MATH 009C or MATH 09HC (may be taken concurrently); PHYS 040A or PHYS 040HA with a grade of "C-" or better. **Designed for engineering and physical sciences students. Covers topics in mechanics and thermodynamics including elasticity; oscillations; gravitation; fluids; mechanical waves and sound; temperature, heat, and the laws of thermodynamics; and the kinetic theory of gases. Laboratories provide exercises illustrating the experimental foundations of physical principles and selected applications.** Credit is awarded for only one of PHYS 040B or PHYS 040HB.

**PHYS 040C General Physics 5** Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): MATH 009C or MATH 09HC; PHYS 040B or PHYS 040HB with a grade of "C-" or better. **Designed for engineering and physical sciences students. Covers topics in electricity and magnetism including electric fields and potential; Gauss' law; capacitance; magnetic fields; Ampere's law; Faraday's law and induction;**

electromagnetic oscillations; dc and ac current; and circuits. Laboratories provide exercises illustrating the experimental foundations of physical principles and selected applications. Credit is awarded for only one of PHYS 040C, PHYS 040HC, PHYS 002B, PHYS 02HB, or PHYS 041B.

**STAT 010 Introduction to Statistics 5** Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): MATH 005A or MATH 006B or MATH 007A or MATH 009A or MATH 09HA. A general introduction to descriptive and inferential statistics. Topics include histograms; descriptive statistics; probability; normal and binomial distributions; sampling distributions; hypothesis testing; and confidence intervals. Credit is awarded for one of the following STAT 010 or STAT 008.

### 1. Upper-division requirements (core)

**BCH 100 Introductory Biochemistry 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of C- or better; CHEM 08HB with a grade of C- or better or CHEM 008B with a grade of C- or better; CHEM 08LB with a grade of C- or better or CHEM 08HLB with a grade of C- or better. Introduction to the biochemistry of living organisms based on a study of the structure, function, and metabolism of small molecules and macromolecules of biological significance. Examines selected animals, plants, and microorganisms to develop a general understanding of structure-function relationships, enzyme action, regulation, bioenergetics, and intermediary metabolism. Credit is awarded for one of the following BCH 100 or BCH 100H. Credit is not awarded for BCH 100 if a grade of "C-" or higher has been awarded previously in BCH 110A or BCH 110HA or BCH 110B or BCH 110HB or BCH 110C or BCH 110HC.

**BCH 110A General Biochemistry 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of "C-" or better; CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 08HLC with grades of "C-" or better. Considers the structure and function of biological molecules including proteins, carbohydrates, lipids, and nucleic acids. Credit is awarded for only one of BCH 110A or BCH 110HA.

**BIOL 102 Introductory Genetics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 020 or BIOL 05LA, and BIOL 005B with grades of "C-" or better. An introductory course that includes classical Mendelian genetics, linkage and recombination, sex-linked traits, cytogenetics, developmental genetics, and molecular genetics. Also includes some probability theory and statistics.

**BIOL 107A Molecular Biology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 008C and CHEM 08LC, or CHEM 08HC and CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BHC 110HA. The study of the structure and function of the genetic material, including DNA structure, DNA replication and recombination, regulation of gene expression, and protein synthesis. Examines both prokaryotic and eukaryotic systems including contemporary recombinant DNA technology and applications of molecular cloning procedures. Credit is not awarded for BIOL 107A if it has already been awarded for BCH 110C.

**BCH 110C General Biochemistry 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA with a grade of "C-" or better, BIOL 102 or consent of instructor. BCH 110B or BCH 110HB is highly recommended. Considers regulation of gene expression, protein synthesis, chromatin structure, genome replication, recombination, and repair. Examines both prokaryotic and eukaryotic systems,

including recombinant DNA technology, protein engineering, and applications to molecular medicine. Credit is not awarded for BCH 110C if it has already been awarded for BCH 110HC or BIOL 107A.

**BCH 110HC Honors General Biochemistry 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA with a grade of "C-" or better. BCH 110B or BCH 110HB is highly recommended. Honors course corresponding to BCH 110C. [Considers regulation of gene expression, protein synthesis, chromatin structure, genome replication, recombination, and repair. Examines both prokaryotic and eukaryotic systems, including recombinant DNA technology, protein engineering, and applications to molecular medicine.](#) Credit is not awarded for BCH 110HC if it has already been awarded for BCH 110C or BIOL 107A.

**GNBT 100 Biotechnology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL102 with a grade of "C-" or better. [Introduces fundamental techniques used in biotechnology and the molecular biological foundations of biotechnology. Topics include gene cloning, the science of genetically modified organisms \(GMOs\), microbial and synthetic biology, the design of new purpose-driven organisms and microbial cell factories, biosensing, gene editing, and other contemporary topics in biotechnology.](#)

**GNBT 110 Advanced Genetics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL102 with a grade of "C-" or better. [Teaches the process of associating genes with biological function. Topics include genetics screens, gene characterization, and discovery of genetic pathways. Examines the rationale and design of experiments to investigate hypothesis-driven questions using genetic approaches.](#)

**GNBT114 Molecular Genetics Laboratory 4** Lecture, 2 hours; laboratory, 6 hours. Prerequisite(s): BIOL102, with grade of "C-" or better; BIOL107A, may be taken concurrently. [Reinforces important concepts in classical and molecular genetics through laboratory work in basic molecular biology and genetics including DNA manipulation techniques and cloning, gene mapping, and isolation and characterization of mutants in eukaryotic model systems.](#)

## 2. Upper-division requirements and electives for all tracks

**BCH 185 Epigenetics in Development and Disease 4** Lecture, 3 hours; discussion, 1 hour; extra reading, 2 hours. Prerequisite(s): BCH 110C with a grade of C- or better or BCH 110HC with a grade of C- or better or BIOL 107A with a grade of C- or better; or equivalents. [Examines epigenetic regulation of gene expression in mammalian development and human disease. Covers the roles of epigenetic mechanisms in normal homeostasis including mammalian embryogenesis, memory formation, and trans-generational inheritance. Addresses aberrant epigenetic control in major human disorders including cancer, neurological disorders, and systemic disease. Explores epigenetics in regenerative medicine.](#)

**BCH 188 Fundamentals of Genomics Technologies 3** Lecture, 3 hours. Prerequisite(s): BCH 110C with a grade of C- or better or BCH 110HC with a grade of B- or better; BIOL 107A with a grade of C- or better; or equivalent. [A systematic overview of leading and emerging genomics technologies. Emphasizes the biochemical and molecular methods behind different genomic technologies and various applications in areas such as functional genomics, developmental biology, metagenomics, and clinical diagnostics. Course appropriate for biochemistry or other biological sciences majors.](#)

**BIOL 105 Evolution 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C with a grade of "C-" or better, BIOL 102, CHEM 008C and CHEM 08LC, or CHEM 08HC and CHEM 08HLC, MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC, BCH 100 or BCH 110A or BCH 110HA, one course in statistics; or consent of instructor. [Covers the causal interpretation](#)

of organic diversity and adaptation. Topics include inference of evolutionary change from the fossil record and from genomic and molecular patterns; microevolution and macroevolution; systematics and the species problem; and natural selection, drift, and other forces of evolution.

**BIOL 107B Advanced Molecular Biology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 107A or BCH 110C or BCH110HC or equivalents. An advanced treatment of the functional architecture of genetic material. Topics include genome structure and chromosome organization, DNA replication and gene expression, cloning organisms, molecular medicine, protein engineering, and application of modern molecular biology to agricultural problems. Coverage of each topic includes discussion of the impact of the emergent molecular technology on society.

**BIOL 108 Population Genetics and Genomics 4** Lecture, 3 hour; discussion and demonstration, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 008C and CHEM 08LC, or CHEM 08HC and CHEM 08HLC, MATH 007B or MATH 009B or MATH 09HB, PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC, one course in statistics. A study of factors influencing genomic variation in biological populations. Topics include the effects of natural selection and genetic drift on genetic variation, detecting adaptive change from genomic data, why genetic diseases and cancers persist, the evolution of co-operation, adaptation to patho- gens and to a changing environment, and the genetic challenges faced by small conserved populations.

**BIOL 115 Human Genetics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102; BCH 100 or BCH 110A or BCH 110HA. An introduction to human genetics. Topics include human gene organization, chromosome structure, chromosomal aberrations, patterns of single-gene inheritance, multifactorial disorders, developmental biology in medicine, cancer genetics, prenatal diagnosis, personalized health care, gene therapy, and ethical issues in medical genetics.

**BIOL 118 Methods in Molecular Ecology and Evolution 4** Lecture, 2 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): BIOL 005C with a grade of C- or better; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC; STAT 010; BCH 100 or BCH 110A or BCH 110HA. Covers theory, techniques, and analytical methods for interpreting patterns of genetic variation based on current high-throughput DNA sequencing technology. Topics include genotype calling, analysis of population structure, genome-wide association studies, and phylogenetic inference using modern computational methods. Includes laboratory techniques for sequencing library preparation.

**BIOL 119 Introduction to Genomics and Bioinformatics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C with a grade of C- or better; BIOL 102; CHEM 001C or CHEM 01HC; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 100H or BCH 110A or BCH 110HA. An introduction to the science of genomics and bioinformatics. Includes genome sequencing; database techniques; structural, comparative, and evolutionary genomics; and microarray analysis.

**BPSC/BIOL 104 Foundations of Plant Biology 4** Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005C. A study of the plant world from cells to ecosystems. Examines the structure and function of organisms from the major plant groups and their role in the biosphere. The laboratory explores the unique properties of plants. Cross-listed with BIOL 104.

**BPSC/CBNS 109 Epigenetics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102. Introduction to mechanisms that cause a heritable change in phenotype without a change in the genetic

code. Covers DNA modifications, histone modifications, and noncoding RNAs that influence the expression, maintenance, and inheritance of traits. Discusses impacts of epigenetics on multicellular life such as learning, memory, disease, and crosstalk with environments. Cross-listed with CBNS 109.

**BPSC 135 Plant Cell Biology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C; BCH 100 or BCH 110A; or consent of instructor. **Explores concepts of dynamic plant cell structures and functions as revealed by modern technologies such as genetic manipulation and live-imaging of cellular structures and molecules.**

**BPSC/BIOL 143 Plant Physiology 4** Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 08HLC, MATH 007B or MATH 009B or MATH 09HB, PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC, BCH 100 or BCH 110A or BCH 110HA (BCH 100 or BCH 110A or BCH 110HA may be taken concurrently), BIOL 104/BPSC 104; or consent of instructor. **A survey of the fundamental principles of plant physiology including photosynthesis, respiration, water relations, mineral nutrition, growth, morphogenesis, plant hormones, dormancy, and senescence.** Cross-listed with BIOL 143.

**BPSC/BIOL 148 Quantitative Genetics 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 05LA; BIOL 005B; BIOL 005C; BIOL 102; CHEM 001C or CHEM 01HC; CHEM 008C, CHEM 08LC or CHEM 08HC, CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA; STAT 011. **Examines approaches to studying the genetic basis of polygenic metric traits. Includes types of gene action, partitioning of variance, response to selection, and inferring the number and location of quantitative trait loci.** Cross-listed with BIOL 148.

**BPSC 149 Nanobiotechnology 2** Lecture, 1 hour; discussion, 1 hour. Prerequisite(s): BIOL 005C; BIOL 102; CHEM 008C or CHEM 08HC, CHEM 08LC or CHEM 08HLC; PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC or PHYS 040C or PHYS 040HC; restricted to class level standing of junior, or senior; or consent of instructor. **An Introduction to fundamental concepts of the emergent field of nanobiotechnology and its application to plant and medical sciences.** Topics include nanomaterial-mediated genome editing and transformation, targeted and controlled drug delivery, nanosensors for electrical signals and signaling molecules, and cyborg plants and animals with augmented or novel functions.

**BPSC 150 Genes, Selection, and Populations 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102 with a grade of "C-" or better, upper-division standing; or consent of instructor. **Considers the conscious manipulation of allelic frequencies in populations as the basis for domestication of crop and animal species.** Examines the genetic basis and standard strategies for the improvement of targeted characteristics in populations of plants and animals through selection and introgression of specific genes and gene constructs.

**BPSC 183 Plant Biochemistry and Pharmacology of Plant Metabolites 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA, BCH 110B or BCH 110HB; or BCH 100; or consent of instructor. **Explores plant biochemistry and the significance of plant metabolites in medicine and pharmacology.** Focuses on biotechnology, medicinal plants, and plant-derived drugs as well as the biochemical and pharmacological mode-of-action of secondary plant metabolites. Also addresses plant-specific biochemical processes such as photosynthesis. Cross-listed with BCH 183.

**BPSC/ENTM 184 Planning For A Postgraduate Career in Life Sciences 2** Lecture, 1 hour; discussion, 1 hour. Prerequisite(s): restricted to class level standing of junior, or senior; restricted to major(s)

Biochemistry, Biology, Cell, Molecular, and Development, Entomology, Microbiology, Neuroscience, Plant Biology; or consent of instructor. Introduces life science majors to diverse career options in industry, government, and academia. Develops skills for finding and acquiring jobs. Emphasizes careers in the plant sciences, biotechnology, and related areas through presentations by professionals representing a variety of educational levels and careers.

**CBNS 108 Introduction to Developmental Biology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102, CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 08HLC; or consent of instructor. Emphasizes common principles and key concepts that govern development of multiple eukaryotic systems, and how genes control cell behavior during development.

**CBNS/PSYC 121 Developmental Neuroscience 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or consent of instructor. A study of the development of nervous systems. Examines the cellular and molecular mechanisms of neural development and the determinants of cell birth and death, axonal pathfinding, neuronal connections, and development of neural systems underlying behavior. Cross-listed with PSYC 121.

**CBNS/ENTX 150 Cancer Biology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110C or BCH 110HC or BIOL 107A or CBNS 101 (may be taken concurrently with consent of instructor). Explores the origin, development, and treatment of cancer with emphasis on molecular mechanisms. Covers topics such as oncogenes, tumor suppressors, cell cycle and differentiation, AIDS, and hereditary and environmental factors in the development of cancer. Cross-listed with ENTX 150.

**CBNS 165 Stem Cell Biology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 101 or consent of instructor. An introduction to various stem cells, their characteristics, and their niches. Explores the molecular concepts of stem cell self-renewal and tissue and organ development. Illustrates their application in therapies and explains routine methods used in stem cell biology. Reviews current governmental regulations and ethics.

**CBNS 169 Human Embryology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C or consent of instructor. An in-depth study of normal human development from conception through the early postnatal period. Demonstrations use microscopic and other materials specifically adapted for the course. Some consideration is given to abnormal development.

**ENSC/NEM 120 Soil Ecology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 002 or BIOL 005A, BIOL 05LA; CHEM 001C, CHEM 01LC or CHEM 01HC, CHEM 1HLC; ENSC 100; or consent of instructor. A study of soil biota and their relationships with plants and the soil environment. Emphasizes life strategies of soil organisms and methods to study them. Examines importance of microbial and faunal groups from the rhizosphere to the ecosystem. Explores impact on soil fertility, carbon and nitrogen cycles, and Earth's climate. Cross-listed with NEM 120.

**ENSC 133 Environmental Microbiology 4** Lecture, 3 hours, discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 05LA or BIOL 020, BIOL 005B, BIOL 005C; or consent of instructor. Introduction to nonpathogenic microorganisms in the environment. Topics include an introduction to microbial biology and microbial and metabolic genetic diversity; methods; symbiotic interactions; biofilms; and geomicrobiology

and biogeochemistry. Explores life in extreme environments and the effects of the physical and chemical environment on microbes. Cross-listed with MCBL 133.

**ENSC/BPSC 134 Soil Conditions and Plant Growth** 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 104/BPSC 104 or ENSC 100; or consent of instructor. A study of the chemical, physical, and biological properties of soils and their influence on plant growth and development. Topics include soil-plant water relations; fundamentals of plant mineral nutrition; soil nutrient pools and cycles; soil acidity, alkalinity, salinity, and sodicity; root symbioses; and rhizosphere processes. Cross-listed with BPSC 134.

**ENTM 101 Evolution of Insect Genomes** 4 Lecture, 3 hours; research, 3 hours. Prerequisite(s): BIOL 005C with a grade of C- or better; restricted to class level standing of sophomore, junior, or senior. Introduces the field of insect genomics and bioinformatics. Provides hands-on bioinformatic instruction of structural and functional aspects of insect genomes within an evolutionary framework. Topics include the genomic basis of key insect innovations, insect phenotypes such as pesticide resistance, and host plant specialization. Prior knowledge of coding not required.

**ENTM 111 Molecular Biology and Genomics of Human Disease Vectors** 3 Lecture, 2 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of C or better, BIOL 05LA with a grade of C or better. Introduces human diseases transmitted by insects/arthropods (insect vectors) that claim about a million deaths annually and cause enormous suffering globally. Highlights adaptations that have contributed to the evolutionary success of disease vectors as well as biotechnological advances in vector control.

**ENTM/BIOL/BPSC 112 Systematics** 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C or equivalent. Principles and philosophy of classification. Topics include phylogenetic and phenetic methods, species concepts, taxonomic characters, evolution, hierarchy of categories, and nomenclature. Cross-listed with BIOL 112, and ENTM 112.

**ENTM/ENTX/PLPA 125 Pesticides, Biological Organisms, and the Environment** 3 Lecture, 3 hours. Prerequisite(s): two of the following courses; BIOL 005A; BIOL 005B; BIOL 005C; CHEM 008A and CHEM 08LA or CHEM 08HA and CHEM 08HLA; CHEM 008B and CHEM 08LB or CHEM 08HB and CHEM 08HLB; CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 08HLC. An introduction to the chemistry, mode of action, and use of insecticides, acaricides, herbicides, and biopesticides from discovery to environmental interactions. Includes genetics of pesticide resistance development and government regulation. Cross-listed with ENTX 125, and PLPA 125.

**ENTM 126 Medical and Veterinary Entomology** 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005B, BIOL 005C; or consent of instructor. Covers biology, ecology, and management of arthropods that affect human and animal health. Considers arthropods as direct pests and vectors of notorious diseases (e.g., malaria, plague). Also addresses disease epidemiology and prevention, as well as control of pests and associated diseases.

**ENTM/MCBL 139 The Evolution of Conflict and Cooperation: Cheaters and Altruists** 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C; or consent of instructor. Explores the evolution of selfish and selfless behavior. An analysis of the evolutionary forces that create either conflict or cooperation among genes, microorganisms and their hosts, and kin. Cross-listed with ENTM 139.

**ENTM/BIOL 173 Insect Physiology** 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B; CHEM 008A or CHEM 08HA; CHEM 008B or CHEM 08HB; CHEM 008C or CHEM 08HC;

CHEM 08LA or CHEM 08HLA; CHEM 08LB or CHEM 08HLB; CHEM 08LC or CHEM 08HLC; restricted to class level standing of sophomore, junior, or senior; or consent of instructor. [Introduction to principles of insect physiology](#). [Covers growth, development and hormones, cuticle, nervous system, circulation, respiration, digestion, nutrition, excretion, reproduction, water balance, and temperature relations](#). Prior knowledge of insects not required. Cross-listed with BIOL 173.

**GNBT120 Analysis of Genomes Laboratory 4** Lecture, 1 hour; discussion, 1 hour; laboratory, 6 hours. Prerequisite(s): BIOL 005C with a grade of "C-" or better; BIOL 102 with a grade of "C-" or better; MATH 007B or MATH 009B or MATH 09HB with a grade of "C-" or better. [Introduces the key computational approaches used in the analysis of genomes and their functional outputs](#). Topics include genome assembly and annotation, identification and analysis of genomic sequence variation, modern molecular mutant identification, quantitative trait mapping, genome-wide association mapping, mRNA and small RNA profiling, network analysis, and comparative genomics. Computer programming experience is not required.

**GNBT130 Genomes: Structure and Evolution** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL102 with a grade of "C-" or better. [Explores the content of genomes from microbes to plants to animals with emphasis on how they are analyzed and how they diversify and evolve](#).

**GNBT 197 Research For Undergraduates 1 to 4** Research, 3 to 12 hours. Prerequisite(s): upper-division standing; consent of instructor. [Individual research conducted under the direction of a Genetics and Biotechnology-affiliated faculty member](#). A written proposal must be approved by the supervising faculty member and undergraduate advisor. A written report must be filed with the supervising faculty member at the end of the quarter. Course is repeatable.

**GNBT 199 Senior Research 2 to 4** Laboratory, 6 to 12 hours. Prerequisite(s): senior status; a GPA of 3.2 or better in upper-division courses in Genetics and Biotechnology; or consent of instructor. [Individual research on a problem relating to GNBT program goals](#). A written proposal signed by the supervising faculty member must be approved by the GNBT undergraduate advisor. A written report must be filed with the supervising faculty member and submitted to the GNBT undergraduate advisor. Course is repeatable, but total credit toward graduation may not exceed 9 units.

**MCBL/BIOL 121 Introductory Microbiology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A; BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 001C or CHEM 01HC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002A, may be taken concurrently or PHYS 02HA, may be taken concurrently; PHYS 02LA, may be taken concurrently or PHYS 02HLA, may be taken concurrently; BCH 100, may be taken concurrently or BCH 110A, may be taken concurrently or BCH 110HA, may be taken concurrently; STAT 010; or consent of instructor. [An intensive introduction to the fundamental physiology and molecular biology of bacteria and viruses](#). [Covers bacterial and viral molecular genetics, an introduction to microbial pathogenesis, and applications of microbiology in modern societies](#). Cross-listed with MCBL 121. Credit is awarded for one of the following MCBL 121, BIOL 121, or MCBL 131.

**MCBL/BIOL 121L Microbiology Laboratory 3** Lecture, 1 hour; laboratory, 6 hours. Prerequisite(s): BIOL 121 with a grade of C- or better or MCBL 121 with a grade of C- or better. [Laboratory exercises in diagnostic bacteriology, basic virology, and epidemiology](#). Includes fundamental quantitative and diagnostic microbiological procedures, basic mechanisms of microbial genetic exchange, and a project examining

bacterial epidemiology. Cross-listed with MCBL 121L. Credit is awarded for one of the following MCBL 121L, BIOL 121L, or MCBL 131L.

**MCBL/BIOL/PLPA 123 Introduction to Comparative Virology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 05LA or BIOL 020, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 08HLC, MATH 007B or MATH 009B or MATH 09HB, PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC, BCH 100 or BCH 110A or BCH 110HA, one course in statistics; or consent of instructor. **Considers viruses as infectious agents of bacteria, plants, and animals (vertebrates and invertebrates).** Compares the major groups of viruses to each other with respect to their biological and biochemical properties, molecular and genetic characteristics, and modes of replication. Cross-listed with BIOL 123, and PLPA 123.

**MCBL/BIOL 124 Medical Microbiology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A; BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA; STAT 010; or consent of instructor. **An intensive introduction to the fundamental physiology and molecular biology of bacteria and viruses.** Covers research strategies for examining microbial pathogenic mechanisms. Cross-listed with BIOL 124.

**MCBL 126 Microbiomes 3** Lecture, 3 hours. Prerequisite(s): BIOL 005A, BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA; STAT 010; or consent of instructor. **Introduces microbiomes, which are the collections of microorganisms that inhabit particular environments or locations and play crucial roles in agriculture, the environment, and human health and disease.** Covers fundamental knowledge about microbiomes and experimental strategies to understand and utilize microbiomes to prevent or treat human and plant diseases. Credit is awarded for one of the following MCBL 126 or MCBL 226.

**MCBL 127 Microbial Evolution 4** Lecture 3 hours; workshop, 1 hour. Prerequisite(s): BIOL 005A, BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA; STAT 010; or consent of instructor. **Explores essential roles microbes perform in biogeochemical cycles, directly influencing human, plant, and animal health and disease.** Provides important platforms for research and biotechnology. **Details the evolutionary history and processes that underlie the critical roles of microbes.** Credit is awarded for one of the following MCBL 127 or MCBL 227.

**MCBL 129 Host Responses to Viral Pathogens 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A; BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100, may be taken concurrently or BCH 110A, may be taken concurrently or BCH 110HA, may be taken concurrently; or consent of instructor. **Explores host responses to viral infections.** **Presents content that will promote understanding of how viruses interact with innate immune responses of the mammalian host and how these responses impact disease outcomes for better or worse.** Credit is awarded for one of the following MCBL 129 or MCBL 229.

**MCBL/ENSC 133 Environmental Microbiology 4** Lecture, 3 hours, discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 05LA or BIOL 020, BIOL 005B, BIOL 005C; or consent of instructor. **Introduction to nonpathogenic microorganisms in the environment.** Topics include an introduction to microbial biology and

microbial and metabolic genetic diversity; methods; symbiotic interactions; biofilms; and geomicrobiology and biogeochemistry. Explores life in extreme environments and the effects of the physical and chemical environment on microbes. Cross-listed with ENSC 133.

**NEM/BIOL 159 Biology of Nematodes 3** Lecture, 2 hours; discussion and demonstration, 1 hour. Prerequisite(s): BIOL 005A, BIOL 05LA or BIOL 020, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 08HLC, MATH 007B or MATH 009B or MATH 09HB, PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC, BCH 100 or BCH 110A or BCH 110HA, one course in statistics. **An introduction to the biology of nematodes. Topics include the morphology, physiology, development, genetics, behavior, and ecology of nematodes from parasitic and free-living habitats. In the discussion and demonstration section, students observe the comparative morphology and biology of nematodes and give oral presentations on selected nematode life histories.** Cross-listed with BIOL 159.

**PLPA/BIOL/MCBL 120 Introduction to Plant Pathology 3** Lecture, 3 hours. Prerequisite(s): BIOL 005A, BIOL 05LA or BIOL 020, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 008C and CHEM 08LC, or CHEM 08HC and CHEM 08HLC, MATH 007B or MATH 009B or MATH 09HB, PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC, BCH 100 or BCH 110A or BCH 110HA, one course in statistics; or consent of instructor. **An introduction to the study of plant diseases. Topics include diseases and disease-causing agents, host-pathogen interaction during disease development, and strategies for disease management. An optional, separate laboratory is offered.** Cross-listed with BIOL 120 and MCBL 120. Credit is not awarded for PLPA 210 if it has already been awarded for BIOL 120/MCBL 120/PLPA 120 and/or BIOL 120L/ MCBL 120L/ PLPA120L.

**PLPA/BIOL/MCBL 120L Introduction to Plant Pathology Laboratory 1** Laboratory, 4 hours. Prerequisite(s): BIOL 005A, BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA; MCBL 120, may be taken concurrently or BIOL 120, may be taken concurrently or PLPA 120, may be taken concurrently; STAT 010, may be taken concurrently; BIOL 121/MCBL 121 and BIOL 124/MCBL 124 recommended; or consent of instructor. **Covers fundamentals in the use of laboratory instruments and techniques for the detection, isolation, and identification of representative infectious agents that cause disease in plants.** Cross-listed with BIOL 120L, and MCBL 120L. Credit is awarded for one of the following PLPA 120L, BIOL 120L, MCBL 120L, or PLPA 210.

**PSYC 178 Health Psychology 4** Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 002 or SOC 001 or SOC 001H. **An examination of the importance of interpersonal relationships to physical health and effective medical care. Applies social psychological perspectives to such topics as stress-related diseases, placebo effects, doctor-patient interactions, dying, and the hospital environment.**

**APPENDIX III. LETTERS OF SUPPORT (2023-24)**

Dr. Xuan Liu  
Tel: (951) 827-4350  
Email: xuan.liu@ucr.edu

January 30, 2024

Dr. David Nelson  
Department of Botany and Plant Sciences  
University of California  
Riverside, CA 92521

Dear Dr. Nelson,

The Department of Biochemistry supports your proposal for a new B.S. major in Genetics and Biotechnology. We are happy to participate in any way possible. In particular, we will contribute to the new major by allowing undergraduates in the major to take all Biochemistry courses (BCH100, BCH110A, BCH110HA, BCH 110B, BCH 110HB, BCH110C, BCH185 and BCH188) you have listed in your proposal.

Please do not hesitate to contact me if you have any questions or concerns about our level of support.

Sincerely,



Xuan Liu  
Professor  
Department of Biochemistry  
University of California  
Riverside, CA 92521

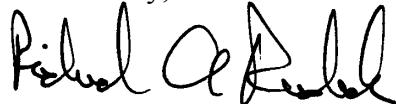
January 9, 2024

Dr. David Nelson  
Department of Botany and Plant Sciences  
University of California  
Riverside, CA 92521

Dear Dr. Nelson,

The Department of Entomology strongly supports your proposal for a new B.S. major in Genetics and Biotechnology. **It is long overdue.** We are happy to participate in any way possible. In addition to the Entomology courses you have listed as contributing to this major, I suggest that you add the following courses as well: ENTM/BPSC/BIOL 112 (*Systematics*-suitable for any of the tracks), ENTM 130 (*Invasion Ecology*-suitable for Biotechnology track), and ENTM 139 (*Evolution of Conflict and Cooperation; Cheaters and Altruists*-suitable for Genetics and Genomics track). These latter courses all have a considerable component of genetics/genomics and/or applied biotechnology. Please do not hesitate to contact me if you have any questions or concerns about our level of support.

Sincerely,



Rick Redak, Chair

DATE: January 18, 2024

TO: David Nelson  
Department of Botany and Plant Sciences

FROM: Morris Maduro, Chair   
Department of Molecular, Cell and Systems Biology

RE: Proposed Genetics and Biotechnology (GNBT) Major

Dear David,

Thank you for meeting with the MCSB department at its faculty meeting of January 8, 2024, to clarify questions about the proposed GNBT major. The faculty are in support of the major, which they see as relevant and likely to appeal to students looking for careers in emerging genetics and biotechnology fields, including Genetic Counseling. Some suggestions were made as follows:

1. The proposed new courses are likely to have significant overlap with existing courses. For example, BIOL 107B and BIOL 115 both have medical genetics topics. As the new GNBT courses are proposed, it would be good to get detailed syllabi of any similar courses to be able to identify such overlaps.
2. The department was concerned about staffing to offer the new GNBT courses. Several majors including CMDB are experiencing issues with several upper-division courses (e.g. CBNS 169, Human Embryology) due to retirements. Finding a way to engage Chairs of other life science departments, and strategic hiring of new faculty (possibly Professors of Teaching as well) will both be important.
3. Additional courses in the life sciences could be included as electives and required courses. This will be helpful for students to complete degree requirements. For example, BIOL 107B could be made a requirement for the Medical Genetics Track because of its coverage of medically relevant genetics topics, and CBNS 101 (Cell Biology) could be added as an elective to the General and Biotechnology tracks.
4. Several of the lower-division courses, while part of the common courses taken by all life sciences majors, add a lot of units that will prevent students from taking many of the major-specific courses. At some point a detailed consideration of the lower-division requirements should be made to see if some could be cut, for example BIOL 005C, or PHYS 002C. We recognize that this is currently a controversial issue across many of the life sciences majors.

**Subject:** Re: request for letter of support for new Genetics and Biotechnology major

**Date:** Tuesday, January 30, 2024 at 3:27:59 PM Pacific Standard Time

**From:** David C Nelson on behalf of David C Nelson

**To:** Joel Sachs, eeobchair, Kurt Anderson

Dear Joel,

Thank you for this letter.

Regarding the points that were raised:

1. We agree and have created a four-year sequence example. We will add these to the proposal package and putatively the catalog (per the examples set by CMDB).
2. We weren't clear on how the transfer student section should be expanded, and we had followed the example of Plant Biology. Per usual practice, advisors will be able to substitute equivalent courses taken at other institutions.
3. We agree with the significance of evolutionary biology to genetics. We have added BIOL 105 as an elective in the Genetics and Genomics track. Other elective courses that discuss evolution are GNBT 130 (now renamed Genomes: Structure and Evolution), MCBL 139 (Evolution of Conflict and Cooperation), ENTM 101 (Evolution of Insect Genomes), BPSC 150 (Genes, Selection, and Populations), BIOL 108 (Population Genetics and Genomics), and BIOL 118 (Methods in Molecular Ecology and Evolution). BIOL 106 (Biology of Human Variation) would be a good addition, too, if it is revived. (The registrar said it has not been taught in 10 years.)

If this satisfies the concerns of EEOB sufficiently, we would greatly appreciate your support for the proposal.

Best regards,

Dave

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**From:** Joel Sachs <joels@ucr.edu>

**Date:** Tuesday, January 2, 2024 at 2:48 PM

**To:** dave <david.nelson@ucr.edu>, eeobchair <eeobchair@ucr.edu>, Kurt Anderson <kurta@ucr.edu>

**Subject:** Re: request for letter of support for new Genetics and Biotechnology major

Dear David,

I write this letter in response to your proposal for a Bachelor of Science Degree Program in Genetics and Biotechnology (GNBT).

I read over your proposal, and I also forwarded it to the faculty of the EEOB Department. The faculty that responded about the proposal were generally supportive and described the plan as well organized and rigorous. I agree with this sentiment and am supportive of the proposal.

A couple of important suggestions were made.

1. The plan could benefit from a sample four-year sequence of courses (the sort that the

staff advisors have for all of the current majors). This plan could be useful to demonstrate what a typical student would need to do to graduate in four (assuming a normal math placement, etc.).

2. The statement about transfer students in section 4 (pg 3) should be expanded, as it might not be suitable to prepare transfer students to graduate on time. The current plan requires a lot of specific courses, and this might make it very challenging to attract transfer students.
3. The major should encourage students to have some training in evolutionary biology. We are concerned that Biol 105 (Evolution) was not even included in the allowable upper-level electives. Evolution is a critical and central model of genetics and students should not get such a degree without some basic training in this field.

Sincerely,

Joel

On Wed, Dec 13, 2023 at 4:17 PM David C Nelson <[david.nelson@ucr.edu](mailto:david.nelson@ucr.edu)> wrote:

Dear Joel,

The Botany and Plant Sciences faculty recently voted to approve the attached proposal for a new B.S. major in Genetics and Biotechnology. This proposal includes the creation of six new courses (four lectures and two laboratories) and two independent research electives.

At this time, we are seeking letters of support from the chairs of UCR departments that teach courses that are listed as requirements or electives for the major, are potentially impacted by the major, or can speak to the appropriateness and utility of adding this major to UCR's current offerings.

If you are willing to do so, we would greatly appreciate a letter of support from you to include with the proposal during the Senate review process. We also invite feedback if there are any courses that we have missed that you feel would be appropriate additions to the list of electives. Finally, we would be grateful if you could inform us of any faculty in your department who express interest in participating in the new program. Although this proposal was initiated within the BPSC department, it is not intended to be exclusive to BPSC. Genetics is a discipline used by many faculty across campus; we hope to form a robust, diverse team of faculty from different departments who are interested in launching and growing this program.

Thank you in advance for your time and consideration of this request. If you have any questions, please don't hesitate to let me know.

Best regards,

Dave

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David Nelson  
Professor of Genetics  
Department of Botany & Plant Sciences  
University of California  
Riverside, CA 92521  
<http://nelsonlab.ucr.edu/>  
(951) 827-4397

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**Joel L. Sachs**  
**Professor & Chair, Evolution Ecology & Organismal Biology**  
University of California, Riverside  
Chair's Office 2745 Life Sciences Building  
Office (951) 827-6357 / Fax (951) 827-4286 / <http://www.sachslab.com>  
Zoom: <http://ucr.zoom.us/my/Sachsevolution>

**Post address:** Sachs Lab - UC Riverside  
3401 Watkins Dr., 1229 Spieth Hall, Riverside, CA 92521

**Subject:** Re: request for letter of support for new Genetics and Biotechnology major

**Date:** Monday, December 18, 2023 at 11:36:21 AM Pacific Standard Time

**From:** Tuppett Yates

**To:** David C Nelson

Hi Dr. Nelson,

If you would draft a letter of support, I'd be happy to sign off with the following caveat: We have not taught 179 in many years and when it was last taught, it was done using the 178 syllabus, which created havoc. Thus, I would NOT include 179 in your proposal. When the course was last taught (more than 3 years ago), there was discussion of either removing it from the books or doing a major overhaul to reduce overlap with 178. At present, the course is in a gray zone with no plans for offering it in the next few years. 178 is taught twice annually (and also in summers). Although it has been taught by associate instructors for many years, we have a new faculty member who is planning to pick it up. Either way, 178 will be offered consistently moving forward and can be included in your proposal.

I hope this information is helpful.

Best,

Tuppett



**Tuppett M. Yates, PhD (she/her)**

Professor & Chair, [UCR Department of Psychology](#)

Director, [Adversity & Adaptation Lab](#)

Executive Director, [Guardian Scholars & Foster Youth Support Services](#)

Department of Psychology | Riverside, CA 92521 | Phone: 951-827-4991

On Wed, Dec 13, 2023 at 4:39 PM David C Nelson <[david.nelson@ucr.edu](mailto:david.nelson@ucr.edu)> wrote:

Dear Dr. Yates,

The Botany and Plant Sciences faculty recently voted to approve the attached proposal for a new B.S. major in Genetics and Biotechnology. This proposal includes the creation of six new courses (four lectures and two laboratories) and two independent research electives.

At this time, we are seeking letters of support from the chairs of UCR departments that teach courses that are listed as requirements or electives for the major, would be potentially impacted by the major, or who can speak to the appropriateness and utility of adding this major to UCR's current offerings. We have listed PSYC 178 and PSYC 179 as requirements for the Medical Genetics/Pre-genetic Counseling track of the proposed major. (We did not list the prerequisite course PSYC 002 as a lower-division requirement because it does not apply to all tracks, but we plan to manage this issue during undergraduate advising.)

If you are willing to do so, we would greatly appreciate a letter of support from you approving the use of these courses, which we would include with the proposal during the Senate review process.

Thank you in advance for your time and consideration of this request. If you have any questions, please don't hesitate to let me know.

Best regards,

Dave

---

David Nelson

Professor of Genetics

Department of Botany & Plant Sciences

University of California

Riverside, CA 92521

<http://nelsonlab.ucr.edu/>

(951) 827-4397



Fred C. Davison Life Sciences Complex  
120 E. Green Street  
Athens, Georgia 30602-7223  
TEL 706-542-8000 | FAX 706-542-3910  
[www.genetics.uga.edu](http://www.genetics.uga.edu)

Franklin College of Arts and Sciences  
*Department of Genetics*

December 14, 2023

Dear Dr. Nelson,

I strongly support the proposed plan for a new B.S. major in Genetics and Biotechnology at the University of California, Riverside. The ability to rapidly sequence DNA and interpret the impact of changes to DNA sequences is positively impacting fields from health to agriculture. There is a growing need from employers for students that understand genetics concepts and genomes from diverse organisms. I have reviewed the proposal to create six new courses (four lectures and two laboratories) and two independent research electives, in addition to integrating relevant courses scattered across different departments at UCR. As the Director of Graduate Studies at the University of Georgia, students who complete this major would be highly qualified to enter our graduate program and hit the ground running. They would also be well prepared for jobs in biotechnology and medicine. I'm excited to see the development of this major, as it will serve your student population well to make them competitive for future careers.

Sincerely,

Dr. Robert J Schmitz  
Director of Graduate Studies  
UGA Foundation Professorship in the Plant Sciences  
Georgia Research Alliance Lars G Ljungdahl Distinguished Investigator  
Professor  
Department of Genetics

# UNIVERSITY OF CALIFORNIA, BERKELEY

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SANTA BARBARA • SANTA CRUZ

SHENG LUAN  
CHANCELLOR'S PROFESSOR AND CHAIR  
DEPARTMENT OF PLANT & MICROBIAL BIOLOGY  
BERKELEY, CALIFORNIA 94720-3102  
111 KOSHLAND HALL #3102  
OFFICE: 510-642-6306  
EMAIL: [SLUAN@BERKELEY.EDU](mailto:SLUAN@BERKELEY.EDU)

December 15<sup>th</sup>, 2023

To whom this may concern,

I heard that UC Riverside plans to implement a new undergraduate major in Genetics and Biotechnology. This is indeed a very timely and exciting educational initiative to train students in an increasingly important and broad area in biomedicine and agriculture. The proposed courses include 4 core lectures and two labs plus other electives across several departments are logical and will integrate strengths in various units across campus. The student trained in this major should be in high demand by the employers in biomedical and agricultural sectors in industry as well as in government units and research enterprises. In particular, the students from this major will be well prepared for graduate studies in genetic and biotech departments at universities across the country. I can see how my department (with a PhD program in genetics and plant biology) will be interested in recruiting students from such a major at UCR. I thus strongly support establishing this major and believe that the students in the major will be well trained and ready for multiple career choices in the future.

Sincerely,

A handwritten signature in black ink, appearing to read "Sheng Luan".

Sheng Luan



OFFICE OF THE PRESIDENT

535 Watson Drive, Claremont, CA 91711

[kgi.edu](http://kgi.edu)

January 5, 2024

Dr. David Nelson, Professor of Genetics  
University of California  
Department of Botany & Plant Sciences  
Riverside, CA 92521

Re: Support for the proposed Bachelor of Science Degree Program in Genetics and Biotechnology (GNBT) at UCR

Dear Dr. Nelson,

I am writing to support your effort to initiate a new undergraduate Bachelor of Science degree program in Genetics and Biotechnology (GNBT) at the University of California, Riverside. I have reviewed your proposed program courses and requirements and find it an outstanding opportunity to offer your students an exciting new career path. I am impressed with the program's design, and if I might, please allow me to provide some background on the sources of my enthusiasm.

First, the program provides a wide range of breadth, underpinned by a requirement for appropriate scientific depth. This combination will ensure an abundance of career options for students who will pursue the GNBT at UCR. In my current role, I interact very often with biotechnology companies where the discussion invariably turns to the supply of staff – at all levels – who come with an understanding of the science underpinning biotechnology and the role that the life sciences will play in the future of health care, environmental remediation and the sustainable production of food. Your proposed program appears to be rigorous, with abundant science content and offers a wide range of courses in all areas of the life sciences to accommodate students' interests. This combination will be an excellent foundation for building a career or pursuing further education. Incidentally, the models now being developed for executive education are often made available during full-time employment. Graduates of your proposed program would be ideally prepared to take advantage of such opportunities for immediate career development and lifelong learning and advancement.

In addition, the range of offerings you will provide will enable graduates to be involved in – and learn about – careers where they can use their skills and abilities optimally. The employment opportunities in regulatory affairs, for example, are essentially invisible to most undergraduate STEM majors, even though the needs in the biotechnology industry far outstrip the supply. Similarly, your students can go to careers, either directly or with limited further study, in advanced biomanufacturing, clinical trial management, or the biotechnology business. These areas provide excellent career opportunities that are largely unknown among undergraduates, and of equal importance, they are employment that often does not require relocation from Southern California. I know your students will appreciate all these benefits of the program!

Finally, as you know, we at KGI have a graduate program in Genetic Counseling and one Genome Data Analytics. Both of these programs have grown substantially in the last few years, driven by the demand in the life sciences industry as well as by increased recognition of the value of precision medicine. Unfortunately, few students in genetics undergraduate programs realize that there are even careers that utilize genetics. As genomic data becomes more available, the needs and opportunities for analyzing and utilizing the information produced will be necessary to advance health care and provide crops that will feed our climate-challenged planet. Your program, as proposed, will bridge the background-to-awareness gap necessary to fill industry needs, but more importantly, it will open new career paths for your students.

As you can tell, I am enthusiastic about your proposed GNBT degree program. I am hopeful that we can work with you and your students as you begin. For example, we would be excited to offer your students opportunities to join our students in activities where they can learn about careers, be mentored by advanced graduate students, or get together to develop a network of beginning professionals. Our Genetic Counseling program has activities that could involve your students, and possible projects are available with our Genome Data Analytics program. Our Bioscience Business program would be excited to have some of your students participate in our industry-sponsored Team Masters Projects. We could also get UCR students involved in the nation's first student chapter of the National Organization for Rare Disorders (NORD).

I hope you are successful in launching this new program as soon as possible. It is well-designed, contains rigorous science, and provides ample opportunities for students to follow areas of interest. Furthermore, it will enable your graduates to pursue rewarding careers and develop a solid foundation for life-long career growth. I am hopeful we can work together to provide opportunities and enrichment for your students.

If you need any further information, please feel free to contact me anytime.

Best of luck with this innovative new program!

Sincerely,

A handwritten signature in black ink, appearing to read "Sheldon M. Schuster".

Sheldon M. Schuster, President



**Institutional Research, 900 University Avenue, 3108 Hinderaker Hall, Riverside, CA 92521**

**TO:** **David Nelson, Professor, Botany & Plant Sciences**

**FROM:** **Scott Heil, Assistant Vice Chancellor for Institutional Research**

**RE:** **Enrollment Data Review for the Genetics & Biotechnology B.S. Program**

The UCR Institutional Research office has completed a review of available academic data related to the proposed Genetics & Biotechnology B.S. degree program. Please see the summary of our observations below.

### **1. Recent Trends in Related Programs at UCR**

UCR has enjoyed extremely high demand for its undergraduate biological sciences programs. In recent years the Biology (BIOL) and Cellular, Molecular & Developmental Biology (CMDB) majors combined have received more admission applications and have admitted more applicants than any other single program at UCR. From fall 2014 to fall 2023, the enrolled headcount of students in those programs grew by more than 50 percent, from 1,945 to 3,020 undergraduates. Total admission applications (combined first-year and transfer) for those two programs increased by nearly 90 percent during the same period. It should be noted that BIOL and related life sciences programs at UCR also have favorable student outcomes, with retention and graduation rates higher than the campus average.

UCR has not had a large new related program in many years, so representative internal examples of new program growth are limited. Figure 1 (attached) shows select application and admission trends for three new undergraduate programs that were first offered within the past eight years: Computer Science with Business Applications (CSBA), Data Science-BCOE (DTSE), and Data Science-CNAs (DTSC).

While none of these are closely related to the subject matter of the Genetics & Biotechnology program, there are perhaps a few parallels with the creation of the CSBA program. UCR already had a large, thriving Computer Science program at the time the CSBA major was launched, and similar to Biology, it already received some of the most admission applications of any UCR undergraduate program. As Figure 1 shows, CSBA began with 290 applications in fall 2017 and initially 13 enrolled first-year undergraduates. Within four years CSBA had reached more than 200 total enrolled students. However, there had already been a small similar Business Informatics (BUNF) program that was being discontinued around the same time, and a number of students who had either applied to or started in that program eventually migrated into CSBA, so in that sense the program did

not start completely from scratch. Meanwhile, the combined enrollment in the two Data Science majors also surpassed enrollment of 200 as of their fourth year being offered.

Based on these admittedly imperfect comparisons, combined with the very large applicant pool for Biology, the proposed enrollment levels for the first several years of the Genetics & Biotechnology B.S. seem quite reasonable.

## **2. Evidence from Other Public R1 Universities**

Comprehensive enrollment data is not available publicly for all universities at the detailed program level. As a proxy, the IR office reviewed a non-representative sample of 11 public R1 universities that have posted their program-level enrollment statistics to a private nonprofit database.<sup>1</sup> For undergraduate programs in either Biotechnology (CIP 26.12) or Genetics (CIP 26.08) we observed the following for the fall 2022 across the sample of 11 universities<sup>2</sup>:

- The average undergraduate program had approximately 80 enrolled students, but with high variability between institutions. The smallest program had a headcount of 16 and the largest had 191, with a median of 42. (Note: One institution reported enrollment under two different genetics CIP codes and for this purpose we added them together and treated them as one program for comparison.)
- Three of the four institutions with enrollment greater than 100 undergraduates in these programs were larger institutions with total undergraduate headcount above 35,000.
- Over the past decade, there was no consistent growth trend in the genetics/biotechnology undergraduate enrollment within each institution. Several of the larger programs reached their peak enrollment before 2019 and have had somewhat declining enrollments in the past three or four years. It should be noted that this does not necessarily mean decreased student interest.

These examples do not consider the focus or specializations of each institution's offerings and it is possible that some of them have emphases substantially different from the proposed program at UCR. However, these examples from other public research institutions suggest that UCR's Genetics & Biotechnology B.S. program would become one of the larger ones among peer institutions. It may

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<sup>1</sup> The Association of American Universities Data Exchange (AAUDE), 2024. Participation in this data system is voluntary and the results may not match those of other published sources. The IR office searched for additional comparison data in another self-reported peer database in which UCR participates, but we found no matching programs submitted in the past two years.

<sup>2</sup> Total undergraduate enrollment at the 11 institutions ranged between 18,000 and 60,000 students.

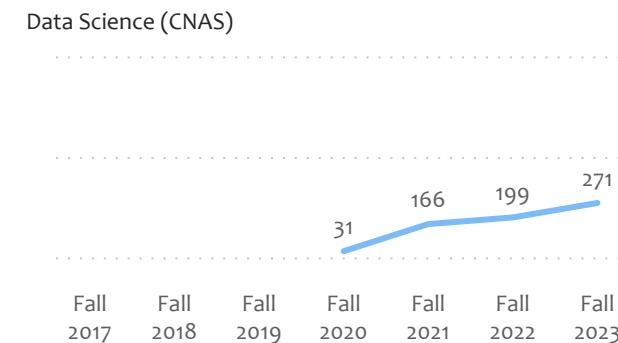
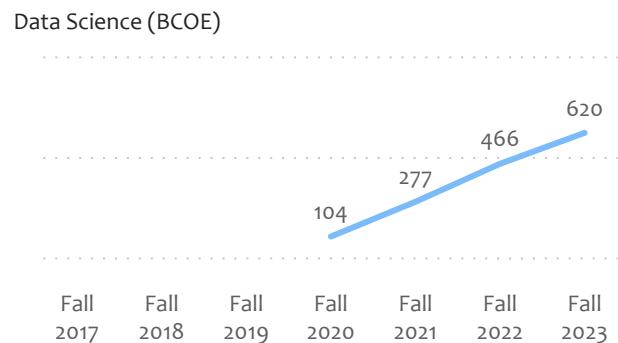
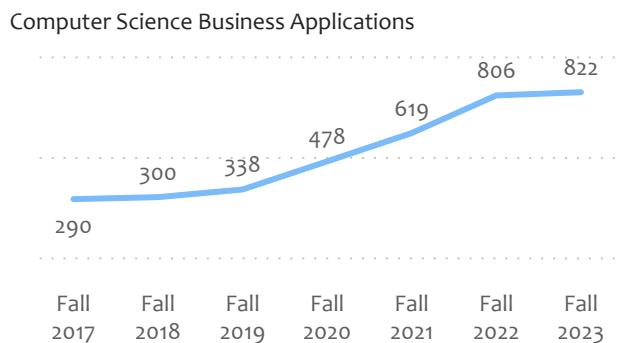
also suggest that there could be upper limits on the size of such programs, whether due to student demand or other constraints, but there is no direct evidence on that from the data we observed.

### **3. Conclusions**

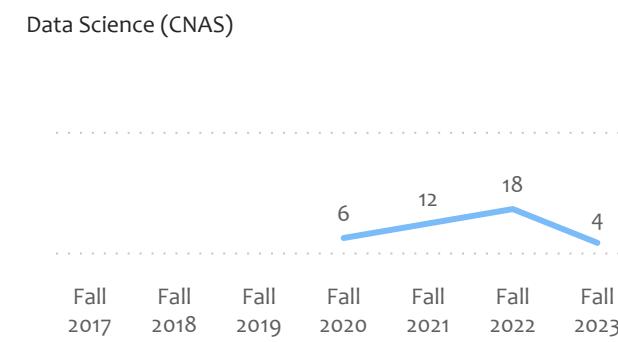
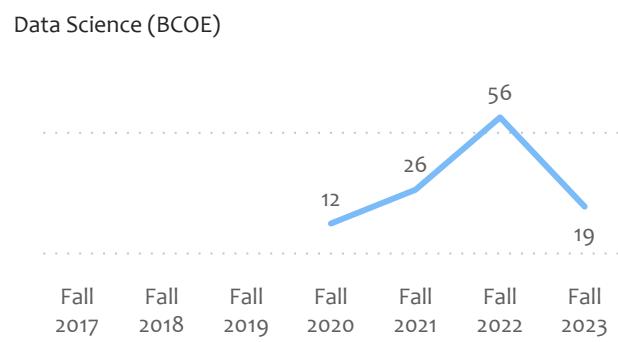
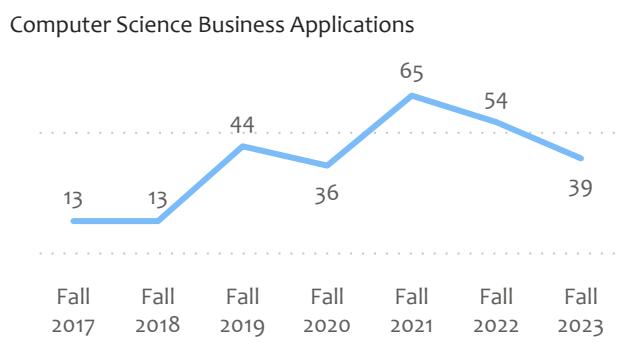
Our analysis suggests good support overall from the data for the enrollment strategy of the proposed Genetics & Biotechnology degree program. It seems likely that, over time, there will be enough undergraduate applications to reach the proposed enrollment numbers, potentially easing the current overload in the Biology major. Despite our efforts, we were unable to find comparable programs at other public R1 universities of similar size, possibly due to limitations in our data sources. Depending on how the application numbers are looking in the early years of this program, you may wish to consider additional strategies to build the program's enrollment. These include offering admission to students who applied for related majors like Biology but were not accepted, and facilitating major changes for students from other life sciences disciplines who may have an interest in this field.

**Figure 1. Selected Examples of Recent New Engineering and Science Majors at UCR**

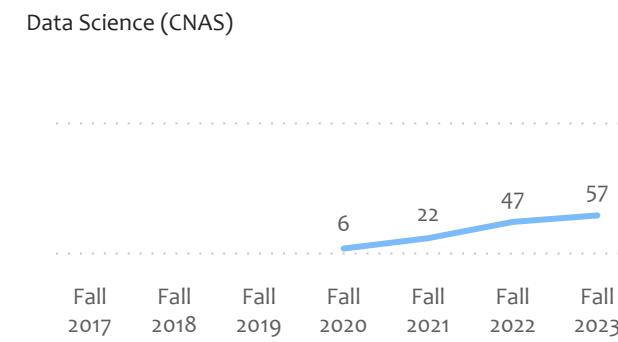
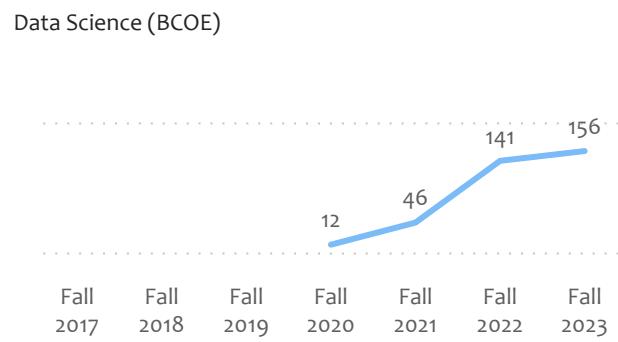
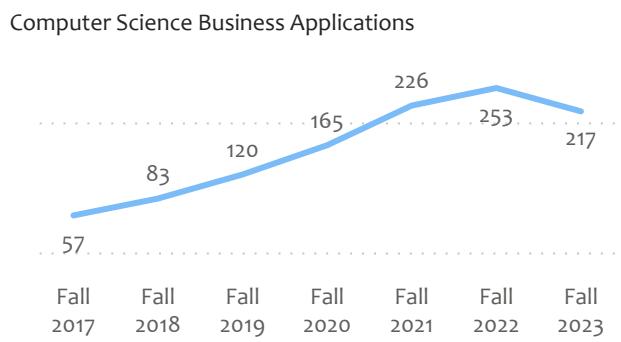
**First-Year Applications**



**First-Year Enrollment**



**Total Enrollment**



**APPENDIX IV. INITIAL SENATE REVIEW (2024)**



*Academic Senate*

**EXECUTIVE COUNCIL**

*Sang-Hee Lee, Chair*

May 8, 2024

To: Bahram Mobasher, Chair, CNAS Faculty Executive Committee

From: Sang-Hee Lee, Chair, Academic Senate

**Re: Proposed Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT])**

Dear Bahram,

On April 22, 2024 Executive Council discussed the subject proposal as part of the agenda and had no comments to add to those attached from the Committee on Courses, Committee on Educational Policy and the CHASS, BCOE, SOM, and SPP Faculty Executive Committees. I provide this and the attached in consideration of a revised proposal.

Should a revision be drafted, please send it forth to my attention with a cc to Executive Director Cherysa Cortez.

Yours,

A handwritten signature in black ink that appears to read 'Sang-Hee Lee'.

Sang-Hee Lee

Chair, Academic Senate

Cc: Director Cortez  
FEC Liaison Lizardi

Attachment

April 15, 2024

TO: Sang-Hee Lee, Ph.D., Chair, Academic Senate, UCR Division

FROM: Marcus Kaul, Ph.D., Chair, Faculty Executive Committee, UCR School of Medicine

SUBJECT: Campus Review - Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT])

Dear Sang-Hee,

The Committee reviewed the proposal for Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT]).

The Committee discussed the proposal of a BS degree meant to give undergrads an up-to-date education in the growing genetics/biotech industry. It combines areas into one degree program, instead of courses being scattered across different disciplines.

The Committee noted that the program overall seems timely given the growing importance of biotechnology in general. While some parts of the proposal appear to link the program to health sciences and thus could give the impression of being a link to premed requirements it seems tailored more for the biotech and genetics industry. The Committee is unclear if this major is indeed intended to also satisfy premed requirements and has some concern that it may give students the misconception that it is a premed-type program.

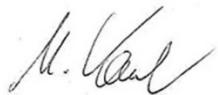
The Committee pointed out there is a sentence in the proposal about “healthcare-related grad programs” which implies that it completes premed requirements. The proposal calls this program a “health-care track”, but the Committee is conflicted with that label as they noted this program may be more appropriately labeled as “healthcare industry/biotech” not to be confused with a health/premed program.

The Committee found it troubling that the program only has a couple of healthcare upper-level requirements and seems a bit like misleading advertising. As the faculty of SOM, they agree that there must be thoughtful consideration about campus advertising health degrees when undergrads could think the program is linked to the SOM when in fact it is not. The healthcare track does not have many healthcare courses, it is only an A and B option with courses that do not seem of core relevance to healthcare. There should be education for healthcare in the upper divisions and most healthcare subjects are electives and the Committee thinks they should be requirements.

The Committee would like to know how this program ties to healthcare. There is a gap between what is offered as courses and what they claim for the program is. The Committee would like to know how the proposal defines healthcare and if it could include more healthcare courses as requirements, not electives.

The Committee would like to see the subject materials and how they define the content of healthcare courses in the degree program.

Yours sincerely,



Marcus Kaul, PhD  
Chair, Faculty Executive Committee School of Medicine

TO: Sang-Hee Lee, Chair  
Riverside Division

FR: Richard M. Carpiano, Chair  
Executive Committee, School of Public Policy

RE: [Campus Review] Proposal: Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT])

Date: April 22, 2024

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The Faculty Executive Committee of the School of Public Policy reviewed the document “[Campus Review] Proposal: Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT]).”

Our Committee had the following comments to report:

- In the “Genetics in Healthcare Track” section b, it is unclear:
  - a. why there is only one class to select (PSYC 178 “Health Psychology”), unlike the other components that offer students a choice in which courses to select to fulfill the area
  - b. what the goal of this lone course is with respect to the track’s curriculum. It appears haphazardly placed.
  - c. why only this course fulfills that requirement and not also other relevant social and behavioral science courses in CHASS, SPP, or elsewhere that focus on social, cultural, and even political dimensions of health, disease, health care, science, and medicine and thus complement the track’s genetic focus as part of the range of contributors to health and disease.

Sincerely,



Richard M. Carpiano, Ph.D., M.P.H.  
Professor of Public Policy



**College of Humanities, Arts, and  
Social Sciences  
EXECUTIVE COMMITTEE**

April 16, 2024

**TO:** Sang-Hee Lee, Chair  
Riverside Division of the Academic Senate

**FROM:** Wesley Leonard, Chair *Wesley Leonard*  
CHASS Executive Committee

**RE:** Proposal: Bachelor of Science Degree Program in Genetics and Biotechnology  
(B.S. in Genetics and Biotechnology [GNBT])

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The CHASS Executive Committee reviewed the new Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT]). The committee is supportive of the new degree program and has no specific concerns about it moving forward but suggests considering different ways to intersect with CHASS disciplines that may bring additional value to the new major. This could provide opportunities for fruitful collaboration with CHASS units that may contribute to the enrichment in areas that the proposal could benefit – for example, in relation to ethical and related social issues, from the point of view of fields such as Native American Studies, regarding how genetic data are used.



*Academic Senate*

**COMMITTEE ON EDUCATIONAL POLICY**

April 8, 2024

To: Sang-Hee Lee, Chair  
Riverside Division

From: Ward Beyermann, Chair  
Committee on Educational Policy

**Re: Proposed B.S. in Genetics and Biotechnology**

The Committee on Educational Policy (CEP) reviewed the proposed B.S. in Genetics and Biotechnology at their April 5, 2024 meeting and voted to approve the proposal.



*Academic Senate*

**COMMITTEE ON COURSES**

April 3, 2024

To: Sang-Hee Lee, Chair  
Riverside Division

From: James Flegal, Chair  
Committee on Courses

**Re: Proposed B.S. in Genetics and Biotechnology**

The Committee on Courses reviewed the proposed B.S. in Genetics and Biotechnology at their April 3, 2024 meeting and had no concerns related to their charge of courses and instruction.

April 25, 2024

**TO:** Sang-Hee Lee, Chair  
Riverside Division of the Academic Senate

**FROM:** Victor G. J. Rodgers, Chair  
BCOE Executive Committee

**RE:** BS in Genetics and Biotechnology

On April 25, 2024, the BCOE Executive Committee reviewed the proposed BS in Genetics and Biotechnology program. The overall sentiment is that program has merit with respect to providing a focus on genetics at the BS level. However, the committee had significant concerns with 'biotechnology' in the title of the program. Providing a program that fulfills student preparation for biotechnology careers was one of the key justifications for starting the Department of Bioengineering in 2006. As stated in the UCR Catalog 2023-24, for the bioengineering major, "The major in Bioengineering allows students to complete a B.S. degree that provides a basic education to enter the fields of bioengineering and biotechnology". In addition, several other programs in BCOE provide training for biotechnology careers. Another concern is that the title may be misleading to students who choose a biotechnology career. Overall, the committee respectfully ask that, prior to moving forward, the proposal be vetted with the departments of Bioengineering, Chemical and Environmental Engineering and Computer Science so that any overlap and ambiguities can be minimized.

**APPENDIX V. COMMENTS FROM BCOE DEPARTMENTS (2024)**



**Bourns College of Engineering**  
Department of Computer Science & Engineering  
900 University Avenue  
Riverside, CA 92521

October 16, 2024

David Nelson  
Professor of Genetics  
Department of Botony & Plant Sciences

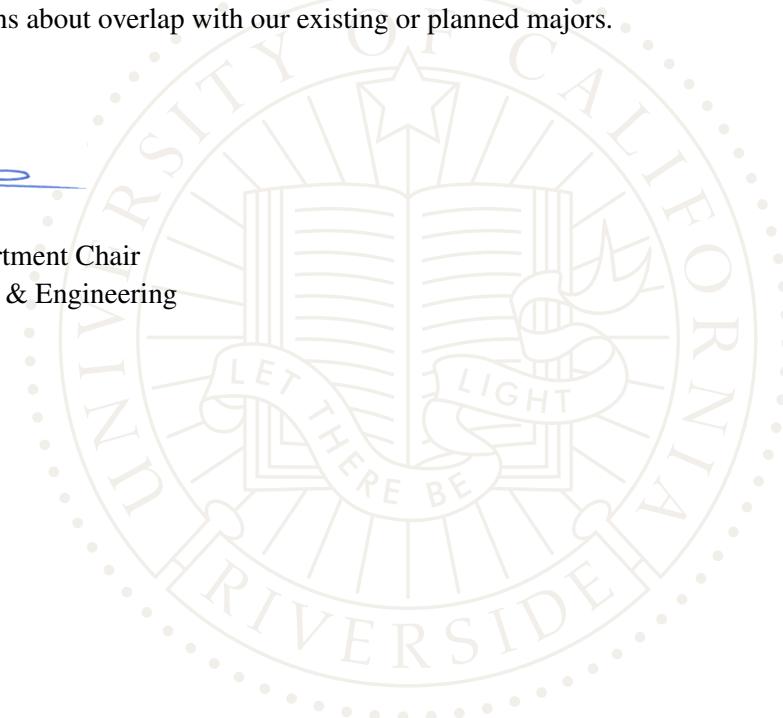
Dear Professor Nelson:

Thank you for forwarding your Proposal for a Bechelor of Science Degree in Genetics and Biotechnology dated January 30, 2024. The Department of Computer Science & Engineering has reviewed the proposal and has no concerns about overlap with our existing or planned majors.

Sincerely,

A handwritten signature in blue ink that reads "Christian Shelton".

Christian Shelton  
Professor & Department Chair  
Computer Science & Engineering



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## proposed Genetics and Biotechnology major

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**David Cocker** <dcocker@engr.ucr.edu>  
To: David Nelson <david.nelson@ucr.edu>  
Cc: "david.cocker@ucr.edu" <david.cocker@ucr.edu>

Tue, Mar 25, 2025 at 8:48 AM

Dear Dr. Nelson,

On behalf of the Department of Chemical and Environmental Engineering, I am pleased to express our strong support for the proposed undergraduate major in Genetics and Biotechnology. The GBNT program complements CEE's MS program in Industrial Biotechnology and will help create a new pipeline of students for this degree program. The foundational training in genetics, molecular biology, and applied biotechnology will prepare students well for advanced study in bioprocessing, metabolic engineering, and related fields. This alignment will strengthen our graduate recruitment and enhance the quality of applicants. The major also fills an important gap in UCR's offerings by providing specialized coursework in genetic engineering, synthetic biology, and bioinformatics. Training in these areas is increasingly critical in the biotech industry, and this program will equip students with the skills needed to succeed in the biotech workforce.

The GBNT major will enhance UCR's academic portfolio and provide valuable opportunities for students.

Sincerely,

David Cocker

Chair, Chemical and Environmental Engineering

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**From:** David Nelson <[david.nelson@ucr.edu](mailto:david.nelson@ucr.edu)>  
**Sent:** Thursday, February 20, 2025 3:00 PM  
**To:** David Cocker  
**Cc:** [david.cocker@ucr.edu](mailto:david.cocker@ucr.edu)

[Quoted text hidden]

[Quoted text hidden]



**Department of Bioengineering**  
Marlan and Rosemary Bourns College of Engineering  
900 University Avenue  
Riverside, CA 92521

December 4, 2024

**TO:** Prof. David Nelson, Department of Botany and Plant Sciences  
**FROM:** Xiaoping Hu, Chair, Department of Bioengineering  
**SUBJECT:** Proposed Bachelor of Science Degree Program in Genetics and Biotechnology

Dear David,

The Department of Bioengineering thanks you for soliciting our feedback about the new undergraduate major proposed by the Department of Botany and Plant Sciences. The subjects that are the focus of the new major—genetics, genomics, and bioinformatics—are extremely important, and we enthusiastically support the creation of a new major for preparing UCR students to work in these areas.

However, we strongly oppose the use of the word “biotechnology” in the name of the proposed major, “Genetics and Biotechnology.” In common use, the term “biotechnology” has expanded far beyond the meaning intended in the proposal and now encompasses virtually all forms of technology in biology and medicine. This will likely lead to confusion among students when selecting their major. We briefly summarize our reasoning for our opposition in this letter.

### **The meaning of the word “biotechnology” has already changed many times**

Researchers have observed that “the word biotechnology has been ‘redeveloped’ at least four times over the years, and its definition has changed on each occasion” [1]. Most dictionaries still show the definition of “biotechnology” that became widespread in the late 1970s and 1980s, when the term was used to describe genetic engineering. It is in that context that the “Genetics and Biotechnology” proposal uses the term.

### **The modern meaning of “biotechnology” has expanded far beyond genetics**

Along with its abbreviation “biotech,” the word “biotechnology” is widely used to refer to all aspects of technology in biology and medicine. A few examples of this usage:

- The **official website of the State of California Office of Business and Economic Development** includes a section entitled “Biotech” that provides details about the



biotechnology industry in California [2]. This section prominently notes that California is the “#1 state exporter of **medical equipment and supplies**.” Medical equipment and supplies are clearly not part of the definition of “biotechnology” used in the new major proposal, and they are not covered in the proposed curriculum for the major (they are, however, a key component of the curriculum of the Bioengineering major at UCR).

- The same state website on biotech [2] uses the terms “**biomedical technology**” and “**life science industry**” as synonymous with “biotech.” Equating these extremely broad terms with “biotechnology” further demonstrates how extraordinarily broad the meaning of “biotechnology” has become.
- The **US Bureau of Labor Statistics (BLS)** provides guidance to individuals seeking jobs in various fields. The BLS report “Jobs in Biotechnology” [3] agrees that the definition of biotechnology has expanded:

*“But what, exactly, is biotechnology?... The answer to that question isn’t easy. Some think biotechnology refers only to the manipulation of genetic material, the use of recombinant DNA... Both the modern definition and the technology have expanded to cover many areas related to biology and medicine.”*

- The same BLS report [3] lists several fields “within biotechnology.” One of these fields is “**Biomedical Engineer**,” which the report defines as:

*“Engineers [who] are behind innovations such as artificial limbs, edible sensors, and sophisticated monitors used during surgery... they may design laser systems for use in corrective eye surgery or develop artificial organs, imaging systems, and devices for regulating insulin.”*

In other words, this US government report defines biotechnology so broadly that it *includes* biomedical engineering/bioengineering. And again, the topics highlighted by the BLS as “within biotechnology” (artificial limbs, sensors, surgery monitors, laser surgery systems, etc.) feature prominently in the Bioengineering curriculum at UCR but are not covered by the proposed “Genetics and Biotechnology” major.

- The NSF-funded “Biotech Careers” website was created to “serve students and others who are considering biotech careers” [4]. The website curates a list of “biotech employers in California.” Nearly 200 of those biotech employers are categorized as “**medical devices**” companies. Again, medical devices are not covered by the proposed “Genetics and Biotechnology” major, but several courses are dedicated to the topic in the Bioengineering major (BIEN 130, BIEN 130L, BIEN 167, and others).



These are just a few examples of authoritative organizations using a definition of “biotechnology” that is far broader than the one used in the new major proposal—a definition so broad that it *includes* biomedical engineering and bioengineering.

### **Undergraduates also use this broad definition of “biotechnology”**

A recent survey of the undergraduates in the Bioengineering major at UCR found that:

- **79%** of student respondents agreed with the statement **“I chose the Bioengineering major because I want to work in the biotechnology industry.”**
- **80%** of student respondents agreed with the statement **“Medical devices (like pacemakers and artificial legs) are examples of biotechnology.”**

These responses show that Bioengineering students overwhelmingly view bioengineering and biotechnology as closely related, that they view bioengineering topics such as medical devices as part of biotechnology (even though these topics do not fit the “traditional” definition of biotechnology used in the major proposal), and that **their interest in biotechnology (as they understand it) motivated their decision to select the Bioengineering major.**

### **Students’ interest in a subject is the main determinant of their choice of major**

A study of over 700 undergraduates found that the most influential factor in choosing their major was **their interest in the subject** [5]. Interest in the major subject outweighed all other factors in picking a major, including the students’ perceived skill in the major, advice they receive from parents/guardians and high school guidance counselors about the major, and even perceived opportunities for jobs and levels of pay in the major.

### **The Bioengineering major was created nearly 20 years ago to serve students interested in biotechnology**

As BCOE Executive Committee Chair and Bioengineering Professor Victor G.J. Rodgers noted in his letter of April 25, 2024,



*“Providing a program that fulfills student preparation for **biotechnology** careers was one of the key justifications for starting the Department of Bioengineering in 2006. As stated in the UCR Catalog 2023-24, ‘the major in Bioengineering allows students to complete a B.S. degree that provides a basic education to enter the fields of bioengineering and **biotechnology**.’”*

**A new major that contains the word “biotechnology” but does not cover the enormous breadth of topics that students associate with biotechnology will likely lead to students choosing the wrong major for their interests**

The term “biotechnology” has grown so broad that many future UCR students would likely be interested in a major with “biotechnology” in the name. These biotech-interested students would likely include many who wish to focus on genetics, genomics, and bioinformatics, and those students would undoubtedly be very well served by the contents of the proposed new major.

However, other biotech-interested students might be interested in fields such as **medical devices**, even though these students would be much better served in Bioengineering or other majors in BCOE.

Other biotech-interested students might be interested in **drug development using conventional approaches** (not genetic engineering). Those students would likely be better served in Biochemistry or other majors in CNAS.

Other biotech-interested students may wish to explore **genetics and genomics from an engineering perspective**, and we already do that in several existing Bioengineering courses.

Still other biotech-interested students might be interested in careers in the **health professions** (“pre-med”) and might assume that a major named “biotechnology” is a better choice for pre-med than other majors in CNAS or BCOE. Dr. Marcus Kaul, Chair of the School of Medicine’s Faculty Executive Committee, echoes this concern in his letter of April 15, 2024, in which he worries that the proposed “Genetics and Biotechnology” major “may give students the misconception that it is a pre-med-type program” and observes that “there is a gap between what is offered as courses and what they claim... the program is.”

We appreciate that the Department of Botany and Plant Science would do everything possible to make sure students understand which aspects of biotechnology are actually covered in the new major. However, most students choose their major long before they set foot on campus, and we fear that (as the research cited above suggests) no amount of advising or website content will



overcome students' preconceived notions of what "biotechnology" means when picking their major.

### **A more specific name will help steer the right students toward the new major**

Finally, we suspect that some students who enter our Bioengineering major have specific interests in genetics, genomics, and bioinformatics—interests that might be better served by the new major. In fact, in the previously mentioned survey of our Bioengineering students, over half of the respondents agreed with the statement:

*"I chose the Bioengineering major because I want to manipulate living organisms (or their components) to produce useful products."*

While we address those topics in some of our Bioengineering courses, those topics would clearly be covered in much greater depth in the proposed new major. A more specific name for the proposed major **would help attract students who might prefer it over Bioengineering and other majors.**

There already exists a Ph.D. program within the Department of Botany and Plant Sciences that seems very similar in subject matter to the proposed new undergraduate major. That Ph.D. program is titled "**Genetics, Genomics, and Bioinformatics**," and that name also seems very suitable for the proposed undergraduate major.

Sincerely,

A handwritten signature in blue ink that reads "Xiaoping Hu".

Xiaoping Hu  
Chair, Department of Bioengineering

### **References**

1. M.J. Kennedy. "The evolution of the word 'biotechnology.'" *Trends in Food Science and Technology* 3, 154-156 (1992).
2. <https://business.ca.gov/industries/biotech/>



3. <https://www.bls.gov/careeroutlook/2002/fall/art03.pdf>
4. <https://www.biotech-careers.org/employers-state-table/CA>
5. C.A. Malgwi, M.A. Howe, and P.A. Burnaby. "Influences on students' choice of college major." *Journal of Education for Business* 80 (5), 275–282 (2005).

**APPENDIX VI. RESPONSE AND SECOND SENATE REVIEW (2025)**

May 1, 2025

 To: Kenneth N. Barish, Chair  
 Riverside Division of the Academic Senate

Re: BS in Genetics and Biotechnology

I am writing to request a vote for approval by the Academic Senate for the Bachelor of Science degree in Genetics and Biotechnology (GNBT) proposed herein. The proposal was reviewed by the Senate in 2023-24 but was not brought forward for a vote by the Chair, Sang-Hee Lee. Below I provide an update on our current progress with courses that were developed for the proposed major and respond to the points of concern raised in last year's Senate review.

### Current GNBT course offerings

Six lecture or lab courses and two independent research courses (GNBT 197 and 199) are currently approved under the GNBT subject code. The first offerings of three courses began this academic year (2024-25). All courses will be offered annually beginning in 2025-26.

### Future GNBT course offerings

This academic year, BPSC conducted searches for an Assistant Professor in Plant Systems Biology or Biotechnology and an Assistant Professor in Translational Plant Sciences. These hires are likely to develop new courses related to **biotechnology** and **synthetic biology** that will add depth to the Biotechnology component of the major.

### Incorporation of GNBT courses into other majors

This year, the Biology; Cell, Molecular, and Developmental Biology; and Biochemistry undergraduate majors approved several GNBT courses for satisfying electives, depth requirements, lab requirements, or related course requirements. The Microbiology, Neuroscience, Entomology, and Plant Biology majors have not yet made decisions about utilizing GNBT courses. GNBT 010 was approved by CHASS as satisfying a science breadth requirement, which will likely increase future enrollments for the course.

Course	CoC approval	first offering	CHASS	Biol	CMDB	BCH
<b>GNBT 010</b> Genetics & Society	effective 2024F (5/9/24)	2025W	Breadth req (1/17/25)	not eligible		Elective (2/26/25)
<b>GNBT 100</b> Biotechnology	effective 2025W (10/30/24)	2025F		to be discussed	Depth (11/22/24)	Elective (2/26/25)
<b>GNBT 110</b> Advanced Genetics	effective 2024F (5/9/24)	2025S		Related Course (2/24/25)	Depth (11/22/24)	Elective (2/26/25)
<b>GNBT 114</b> Molecular Genetics Lab	effective 2024F (5/9/24)	2026S		to be discussed	Lab req (11/22/24)	BCH 110C prereq required
<b>GNBT 120</b> Analysis of Genomes Lab	effective 2024F (5/9/24)	2025W		Related Course (12/9/24)	Lab req (11/22/24)	Elective (2/26/25)
<b>GNBT 130</b> Genomes: Structure & Evolution	effective 2024F (5/9/24)	2026W		to be discussed	Depth (11/22/24)	Elective (2/26/25)
<b>GNBT 197</b> Research units	effective 2025W (10/30/24)	2025F				
<b>GNBT 199</b> Research units	effective 2025W (10/30/24)	2025F				

**Response to the 2023-24 Senate review**

The concerns raised by BCOE in 2023-24 were focused on two issues:

- 1) The Department of Bioengineering was founded with the intent of preparing students for biotechnology careers in 2006. Per the course catalog, "The major in Bioengineering allows students to complete a B.S. degree that provides a basic education to enter the fields of bioengineering and biotechnology." Other programs in BCOE were also noted to provide training relevant to biotechnology careers.
- 2) Including "Biotechnology" in the program title may be misleading to students who seek a biotechnology career.

Therefore, we were requested by the BCOE Executive Committee to vet the proposal with the departments of Bioengineering, Chemical and Environmental Engineering and Computer Science to minimize any overlap and ambiguities. As requested, we contacted each of these departments to discuss their specific concerns and seek solutions.

The Department of Computer Science and Engineering had no concerns. (see attached letter from Department Chair, Professor Christian Shelton)

The Department of Chemical and Environmental Engineering provided strong support for the major, which they view as a potential pipeline to their MS program in Industrial Biotechnology. (see attached letter from Department Chair, Professor David Cocker)

The Department of Bioengineering expressed enthusiastic support for the content and purpose of the major, but continued to strongly oppose the use of "biotechnology" in the name of the proposed GNBT major. (see attached letter from Department Chair, Professor Xiaoping Hu)

BIEN's arguments against the use of "biotechnology" by GNBT can be summarized as  
1) "Biotechnology" has come to mean more than "genetic engineering" and now encompasses many forms of technology related to biology and medicine, such as sensors/testing devices, artificial limbs/organs, and surgical tools.

2) Undergraduates may not appreciate the difference between the forms of biotechnology training offered by Bioengineering and GNBT and therefore may choose the wrong major for their career interests.

We respectfully disagree with these arguments.

The term **biotechnology**, coined by Karl Ereky in 1919, originally referred to using biological systems (e.g. bacteria, yeast, and plants) as tools to produce valuable products. The later work of Paul Berg, the so-called "father of biotechnology" laid the foundations of genetic engineering by establishing recombinant DNA methods. While we fully agree that the meaning of biotechnology has gradually broadened over subsequent decades to encompass a more diverse set of disciplines than genetic engineering, we are by no means being misleading to students in our usage of the word.

In fact, genetic engineering remains prominent in the popular conception of biotechnology. For example, DNA images feature prominently in a Google Image search of "Biotechnology." The "Biotechnology" entry in Wikipedia (<https://en.wikipedia.org/wiki/Biotechnology>), a resource commonly used by students, closely aligns with our vision for the Biotechnology track of the GNBt major. It heavily emphasizes genetic manipulation of biological systems. By contrast, the "Biomedical Engineering" entry ([https://en.wikipedia.org/wiki/Biomedical\\_engineering](https://en.wikipedia.org/wiki/Biomedical_engineering)) closely aligns with the Bioengineering major and emphasizes biomechanics, biomaterials, biomedical optics, tissue engineering, hospital and medical devices (for imaging, implants, bionics, biomedical sensors). Therefore, GNBt course offerings will complement those offered by the BIEN department. This will improve the opportunities for UCR students to gain training in biotechnology-relevant topics rather than lessen them.

The name "Genetics and Biotechnology" implies a connection between the two topics, alluding to the program's focus on the genetic engineering forms of biotechnology. We believe that UCR students are quite capable of determining if BIEN or GNBt courses better match their interests by reading the course catalog descriptions. However, we will also take the following actions to prevent any of the potential confusion anticipated by Bioengineering:

- 1) We will change the name of the proposed Biotechnology track within the major to Genetic Biotechnology to underscore which subdiscipline of biotechnology we are referring to.
- 2) We will add the following text to the course catalog description for the Genetics and Biotechnology major:

"The Genetic Biotechnology track offers more opportunities for organism-specific training in preparation for careers in the biomedical, microbial, or plant biotechnology industries. This track is focused on modifying living systems through genetic manipulation. Students interested in biomedical engineering (e.g. developing artificial limbs or organs, sensors, or medical devices) should enroll instead in the Bioengineering major of the Bourns College of Engineering."

- 3) In our meetings with first-year undergraduates and transfer students, GNBt faculty advisors and CNAS advisors will bring up the distinctions in subject focus between the BIEN and GNBt majors.

We believe strongly in the use of "Biotechnology" in the name of the proposed major for two reasons. First, we wish to convey the importance of applying genetic knowledge as well as discovering it. Translation of knowledge from genetic research into biotechnological applications is a priority for many CNAS faculty. We seek students who are excited about developing innovative solutions to global problems. Second, we aim to attract students considering future careers in this area. Our major will provide training that is appropriate for seeking employment in the biotechnology industry, which is a robust component of the California economy.

The concerns raised by the School of Medicine were focused on whether "Genetics in Healthcare" track was misleadingly named and could lead students to confuse it with a health/premed program. After discussing the typical expectations for medical school applicants at UCR with Prof. Marcus Kaul, there were no obvious reasons why the GNBt major would be less satisfactory preparation for medical school than any other biological major. Nonetheless, we have changed the name for this track to "Pre-Genetic Counseling" to reflect its original intent. Our selection of courses for this track was based upon researching the typical prerequisites for Genetic Counseling programs.

The School of Public Policy also raised concerns about the "Genetics in Healthcare" track, particularly with regard to the selection of a single course in "Health Psychology" (PSYC 178) that seemed haphazardly placed. This specific course was selected based upon our survey of Genetic Counseling program prerequisites. We agree that there are many more important dimensions to health and disease that are not integrated into this track. However, there is limited space for upper-division course requirements and our intent is to maintain a focus on genetics. Therefore, we have changed the name of this track to "Pre-Genetic Counseling" to indicate this narrower scope.

We have also changed the catalog description to read

**"The Pre-Genetic Counseling track has a reduced lab requirement and focuses on the typical prerequisites for postgraduate genetic counseling programs. It provides preparation for working with human genetic data that may be applicable to healthcare settings."**

We hope that these changes address the concerns raised by the Senate units satisfactorily. We look forward to launching the GNBT program in the near future.

Sincerely,



Professor of Genetics  
Botany and Plant Sciences  
University of California, Riverside  
david.nelson@ucr.edu  
(951) 827-4397



**Academic Senate**  
Professor Kenneth Barish  
Division Chair

December 9, 2025

David Nelson  
GNBT Program Lead Proponent, Department of Botany and Plant Sciences

Re: 2nd Round - Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT])

Dear David,

Please see the attached feedback on the subject proposal.

Should you decide to revise and resubmit a proposal for this program, please send it to my attention with a courtesy copy to Senate Executive Director Cherysa Cortez ([cherysac@ucr.edu](mailto:cherysac@ucr.edu)).

Best regards,

A handwritten signature in blue ink that reads "Ken Barish".

Ken Barish  
Chair, Academic Senate

Encl.

Cc: CNAS Faculty Executive Committee Chair Tom  
Senate Director Cortez  
Senate Analyst Beatty  
CNAS Faculty Executive Committee Analyst Grawe

TO: Ken Barish, Chair  
Riverside Division

FR: Kurt Schwabe, Chair *Kurt Schwabe*  
Executive Committee, School of Public Policy

RE: **[Comments] Proposal: 2nd Round - Bachelor of Science**

Date: October 23, 2025

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The Executive Committee of the School of Public Policy has reviewed the **Proposal: 2nd Round - Bachelor of Science**. We appreciate the effort, considerations, and updates from previous comments and concerns we and others raised. *Previously*, we had three comments:

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[SPP Comments:

“In the “Genetics in Healthcare Track” section b, it is unclear:  
a. why there is only one class to select (PSYC 178 “Health Psychology”), unlike the other components that offer students a choice in which courses to select to fulfill the area  
b. what the goal of this lone course is with respect to the track’s curriculum. It appears haphazardly placed.  
c. why only this course fulfills that requirement and not also other relevant social and behavioral science courses in CHASS, SPP, or elsewhere that focus on social, cultural, and even political dimensions of health, disease, health care, science, and medicine and thus complement the track’s genetic focus as part of the range of contributors to health and disease.”

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We appreciate the reasoning and recognize that you changed the title of the track to “Pre-Genetic Counseling in Healthcare Track.” That said, we are still a bit surprised that there isn’t more flexibility for course substitutes for Psychology 178 since (i) there are other courses that provide other important dimension on health from a social science perspective that still seem to fit into your overall objectives and (ii) more viable options would likely lead to fewer impediments from a scheduling perspective for students.

Overall, though, we are supportive of the program.



October 31, 2025

TO: Ken Barish, PhD, Chair, Academic Senate, UCR Division

FROM: Adam Godzik, Ph.D., Chair, Faculty Executive Committee, UCR School of Medicine

SUBJECT: **[Campus Review] Proposal: 2nd Round - Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT])**

Dear Ken,

The SOM Faculty Executive Committee has reviewed the [Campus Review] Proposed Regulation Change: *Changes to UCR Regulations 2, 3, and 4*

The FEC had no additional comments and approved the changes.

Yours sincerely,

DocuSigned by:

A handwritten signature in black ink that reads 'Adam Godzik'.

F3F7FC0ECB4E4AD...

Adam Godzik, Ph.D.  
Chair, Faculty Executive Committee School of Medicine



College of Humanities, Arts, and  
Social Sciences  
EXECUTIVE COMMITTEE

October 31, 2025

TO: Ken Barish, Chair  
Riverside Division of the Academic Senate

FROM: Iván Aguirre, Interim Chair  
CHASS Executive Committee

RE: [Campus Review] Proposal: 2nd Round - Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT])

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The CHASS Executive Committee reviewed the Proposal: 2nd Round - Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT]). The committee is supportive of the B.S. in Genetics and Biotechnology proposal: 2<sup>nd</sup> Round and has no concerns. The committee reiterates the suggestion from the 1<sup>st</sup> round of the proposal to consider the pursuit of different ways to intersect with CHASS disciplines, which may add value and interest for the new major.



November 4th, 2025

TO: Kenneth N. Barish, Chair, Academic Senate, UCR Division

FROM: Harry Tom, Chair, Faculty Executive Committee, College of Natural and Agricultural Sciences

SUBJECT: [Campus Review] Proposal: 2nd Round - Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT])

Prof. Barish,

The CNAS Faculty Executive Committee has reviewed the second round proposal for the B.S. in Genetics and Biotechnology and feel that the concerns noted in the first round of review were sufficiently addressed and changes made to the proposal align with provided suggestions. The committee approves the proposal, with no additional comments or suggestions.

Sincerely,

A handwritten signature in black ink that reads "Harry W K Tom".

Harry Tom, Ph.D  
Chair, Faculty Executive Committee, College of Natural and Agricultural Sciences



Cherysa Cortez &lt;cherysac@ucr.edu&gt;

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## [Campus Review] (Proposal) 2nd Round - Bachelor of Science Degree Program in Genetics and Biotechnology (B.S. in Genetics and Biotechnology [GNBT])

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**Vagelis Hristidis** <vagelish@gmail.com>

Wed, Nov 26, 2025 at 1:03 PM

To: Cherysa Cortez &lt;cherysa.cortez@ucr.edu&gt;

Cc: "Rod Smith (roderick.smith@ucr.edu)" &lt;roderick.smith@ucr.edu&gt;

Hi Cherysa,

BIEN faculty met with CNAS faculty and agreed on the following changes:

- (1) They have agreed to remove all references to the Bioengineering major from the relevant catalog description.
- (2) We reached common ground on renaming the proposed major "Genetics and Molecular Biotechnology" (instead of the originally proposed "Genetics and Biotechnology").

So I guess BIEN will submit a new version of the proposed degree.

Thanks,

Vagelis

[Quoted text hidden]



*Academic Senate*

**COMMITTEE ON EDUCATIONAL POLICY**

October 3, 2025

To: Ken Barish, Chair  
Riverside Division

From: Annie Ditta, Chair  
Committee on Educational Policy

**Re: Second Round Review of Proposed B.S. in Genetics and Biotechnology**

The Committee on Educational Policy (CEP) reviewed the revised proposal for the B.S. in Genetics and Biotechnology at their October 3, 2025 meeting and voted to support the proposal.



*Academic Senate*

**COMMITTEE ON COURSES**

October 24, 2025

To: Ken Barish, Chair  
Riverside Division

From: Emma Stapely, Chair  
Committee on Courses

**Re: Revised Proposal for B.S. in Genetics and Biotechnology**

The Committee on Courses reviewed and voted to support the revised proposal for a B.S. in Genetics and Biotechnology at their October 23, 2025 meeting with the reminder that all new course proposals for the curriculum need to be submitted in the Course Request System (CRS).