UNIVERSITY OF CALIFORNIA
UC RIVERSIDE

College of Natural and Agricultural Sciences
UC Division of Agriculture and Natural Resources
Agricultural Experiment Station and Cooperative Extension

Proposal for a Bachelor of Science Degree Program in Genetics and 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 Biotechnology (GNBT)

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

1. *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 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://cabiotech.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 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, 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. degree program at UCR 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 Biotechnology undergraduate program to UCR would showcase the existing strengths of CNAS faculty in this area and help keep us competitive with peer institutions.

2. *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, and CBNS. 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 to provide a well-rounded training in genetics.

The second major focus of GNBT, 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 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.

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. 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.

3. *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 Genetics and 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, Medical Genetics or Pre-Genetic Counseling, or Biotechnology. The Genetics and Genomics track provides broad training in genetic theories and analysis. The Medical Genetics or Pre-Genetic Counseling track has a reduced lab requirement and a greater focus on prerequisites for health-related postgraduate programs (e.g. health psychology and human development). The Biotechnology track offers more opportunities for organism-specific training in preparation for careers in the biomedical, microbial, or plant biotechnology industries.

Major Requirements (see Appendix I for course descriptions)

1. Lower-division requirements (72-77 units)

a) BIOL 005A, BIOL 005B, BIOL 005C; BIOL 05LA or BIOL 020

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 008LA, CHEM 008LB; or CHEM 08HA, CHEM 08HB, CHEM 08HLA, CHEM 08HLB

d) PHYS 002A, PHYS 002B, PHYS 02LA, PHYS 02LB, PHYS 002C, PHYS 02LC; or PHYS 02HA, PHYS 02HB, PHYS 02HLA, PHYS 02HLB, PHYS 02HC, PHYS 02HLC; or PHYS 040A, PHYS 040B, PHYS 040C; or PHYS 040HA, PHYS 040HB, PHYS 040HC

e) MATH 007A or MATH 009A or MATH 09HA; MATH 007B or MATH 009B or MATH 09HB

f) STAT 010

g) BCH 100; or BCH 110A and BCH 110B; or BCH 110HA and BCH 110HB

h) GNBT 010 (Genetics and Society)

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.

2. Upper-division requirements (36-38 units) (see Appendix I for course descriptions)

a) Major core (20 units) BIOL 102, BIOL 107A or BCH 110C or BCH 110HC, GNBT 100 (Biotechnology), GNBT 110 (Advanced Genetics), GNBT 114 (Molecular Genetics Lab)

b) Major electives (16-18 units from one of the following tracks):

Genetics and Genomics

i) GNBT 130 (Genomes)

ii) one laboratory course: GNBT 120 (Analysis of Genomes) or BIOL118 or BIOL121L or 4 units of GNBT 197/199*

iii) two or more of the following (8-12 units): BCH 188, BIOL 107B, BIOL 108, BIOL 115, BIOL 119, BIOL 121, BIOL 148, BPSC 109, BPSC 112, BPSC 150, BPSC 184, CBNS 108, CBNS 150, CBNS 165, ENTM 111

Medical Genetics or Pre-Genetic Counseling

i) GNBT 120 or GNBT 130 or BIOL 119

ii) PSYC 178 (note prerequisite(s): PSYC 002 or SOC 001 or SOC 001H) or PSYC 179 (note prerequisite(s): grade of “C-” or better in HNPG 042K or PSYC 002 or PSYC 178)

iii) two or more of the following (8-12 units): BCH 185, BCH 188, BIOL 107B, BIOL 108, BIOL 115, BIOL 118, BIOL 121, BIOL 148, BPSC 109, CBNS 108, CBNS 121, CBNS 150, CBNS 165, CBNS 169, ENTM 111, GNBT 120, GNBT 130, MCBL 123, MCBL 124, MCBL 129, MCBL 139, or 4 units of GNBT 197/199*

Biotechnology

i) one or two laboratory courses: GNBT 120, BIOL121L, BPSC 104, BPSC 143, PLPA 120 and PLPA 120L, or 4 units of GNBT 197/199*

ii) two or more of the following (8-16 units): GNBT 130, BCH 188, BIOL 107B, BIOL 119, BIOL 121, BIOL 148, BPSC 109, BPSC 134, BPSC 135, BPSC 149, BPSC 150, BSPC183, BPSC184, CBNS 108, CBNS 150, CBNS 165, ENTM 101, ENTM 111, ENTM 125, ENTM 126, ENTM 173, MCBL 123, MCBL126, MCBL 127, MCBL 129, MCBL 139

*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.

Genetics and Biotechnology (GNBT)

Lower-division requirements (72-77 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 (8 U): CHEM008A+B and CHEM08LA+LB (or honors versions)
general physics (15 U): PHYS002A+B+C and PHYS02LA+LB+LC (or honors versions, or PHYS40 ABC series w/o labs)
calculus (8 U): MATH007A+B or MATH009A+B or MATH09HA+B
intro statistics (5 U): STAT010
biochemistry (4-8 U): BCH100 or BCH110A+B or BCH110HA+HB
GNBT010 Genetics and Society (4 U)

Core courses (20 units)

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

i) GNBT130 Genomes (4 U)

ii) one lab
GNBT120 Analysis of Genomes (4 U)
BIOL118 Methods in Molecular Ecology and Evolution (4 U)
BIOL121L Microbiology Laboratory (4 U)
GNBT197/199 Research for Undergraduates (4 U total)

iii) two or more electives (8-12 units)
BCH188 Fundamentals of Genomics Technologies (3 U)
BIOL107B Advanced Molecular Biology (3 U)
BIOL108 Population Genetics and Genomics (4 U)
BIOL115 Human Genetics (4 U)
BIOL119 Introduction to Genomics and Bioinformatics (4 U)
BIOL121 Introductory Microbiology (4 U)
BIOL148 Quantitative Genetics (4 U)
BPSC109 Epigenetics (4 U)
BPSC112 Systematics (4 U)
BPSC150 Genes, Selection, and Populations (4 U)
BPSC184 Planning a Postgraduate Career in Life Sciences (2 U)
CBNS108 Introduction to Developmental Biology (4 U)
CBNS150 Cancer Biology (4 U)
CBNS165 Stem Cell Biology (4 U)
ENTM111 Mol Biol & Genomics of Human Disease Vectors (3 U)

Biotechnology

i) one or two labs (4-8 units)
GNBT120 Analysis of Genomes (4 U)
BIOL121L Microbiology Laboratory (4 U)
BPSC104 Foundations of Plant Biology (4 U)
BPSC143 Plant Physiology (4 U)
PLPA120+120L Introduction to Plant Pathology with Lab (4 U)
GNBT197/199 Research for Undergraduates (4 U total)

ii) two or more electives (8-16 units)
GNBT130 Genomes (4 U)
BCH188 Fundamentals of Genomics Technologies (3 U)
BIOL107B Advanced Molecular Biology (3 U)
BIOL119 Introduction to Genomics and Bioinformatics (4 U)
BIOL148 Quantitative Genetics (4 U)
BPSC109 Epigenetics (4 U)
BPSC134 Soil Conditions and Plant Growth (4 U)
BPSC135 Plant Cell Biology (4 U)
BPSC149 Nanobiotechnology (2 U)
BPSC150 Genes, Selection, and Populations (4 U)
BSPC183 Plant Biochem. & Pharm. of Plant Metabolites (4 U)
BPSC184 Planning a Postgraduate Career in Life Sciences (2 U)

Medical Genetics or Pre-genetic Counseling

i) one of
GNBT120 Analysis of Genomes (4 U)
GNBT130 Genomes (4 U)
BIOL119 Introduction to Genomics and Bioinformatics (4 U)

ii) one of
PSYC178 Health Psychology (4 U)
PSYC179 Health and Behavior Change (4 U)

iii) 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 (3 U)
BIOL108 Population Genetics and Genomics (4 U)
BIOL115 Human Genetics (4 U)
BIOL118 Methods in Molecular Ecology and Evolution (4 U)
BIOL121 Introductory Microbiology (4 U)
BIOL148 Quantitative Genetics (4 U)
BPSC109 Epigenetics (4)
CBNS108 Introduction to Developmental Biology (4)
CBNS121 Developmental Neuroscience (4)
CBNS150 Cancer Biology (4)
CBNS165 Stem Cell Biology (4)
CBNS169 Human Embryology (4)
ENTM111 Mol Biol & Genomics of Human Disease Vectors (3 U)
GNBT120 Analysis of Genomes (4 U)
GNBT130 Genomes (4 U)
MCBL123 Introduction to Comparative Virology (4 U)
MCBL124 Medical Microbiology (4 U)
MCBL139 The Evolution of Conflict and Cooperation (4 U)
GNBT197/199 Research for Undergraduates (4 U total)

CBNS108 Introduction to Developmental Biology (4 U)
CBNS150 Cancer Biology (4 U)
CBNS165 Stem Cell Biology (4 U)
ENTM101 Evolution of Insect Genomes (4 U)
ENTM111 Mol Biol & Genomics of Human Disease Vectors (3 U)
ENTM125 Pesticides, Biol Organisms, & the Environment (3 U)
ENTM126 Medical and Veterinary Entomology (4 U)
ENTM173 Insect Physiology (4 U)
MCBL123 Introduction to Comparative Virology (4 U)
MCBL126 Microbiomes (3 U)
MCBL127 Microbial Evolution (4 U)
MCBL129 Host Responses to Viral Pathogens (4 U)
MCBL133 Environmental Microbiology (4 U)
MCBL139 The Evolution of Conflict and Cooperation (4 U)
NEM120 Soil Ecology (4 U)
NEM159 Biology of Nematodes (3 U)

4. *A list of faculty who will be involved in the program, including those teaching, advising, and administering.* ***[*** this is a tentative and noncomprehensive list of candidate participating faculty who will need to be contacted to indicate their interest or not *** change color to black font when approval is received]***

Below is the current list of faculty involved in the program (new faculty will be added as the program evolves):

David Nelson, Professor, Botany and Plant Sciences
Daniel Koeing, Assistant Professor, Botany and Plant Sciences
Danelle Seymour, Assistant Professor, Botany and Plant Sciences
Sean Cutler, Professor, Botany and Plant Sciences
Jaimie Van Norman, Associate Professor, Botany and Plant Sciences
Dawn Nagel, Assistant Professor, Botany and Plant Sciences
Thomas Eulgem, Professor, Botany and Plant Sciences
Adam Jozwiak, Assistant Professor, Botany and Plant Sciences
Thomas Girke, Professor, Botany and Plant Sciences
Meng Chen, Professor, Botany and Plant Sciences
Susan Wessler, Professor, Botany and Plant Sciences
Julia Bailey-Serres, Botany and Plant Sciences
Meng Chen, Botany and Plant Sciences
Katayoon Dehesh, Botany and Plant Sciences
Juan Pablo Giraldo, Botany and Plant Sciences
Thomas Girke, Botany and Plant Sciences
Venugopala Reddy, Botany and Plant Sciences
Zhenyu (Arthur) Jia, Botany and Plant Sciences
Hailing Jin, Microbiology and Plant Pathology
Robert Jinkerson, Chemical and Environmental Engineering
Carolyn Rasmussen, Botany and Plant Sciences
Patricia Springer, Botany and Plant Sciences
Jason Stajich, Microbiology and Plant Pathology
Linda Walling, Botany and Plant Sciences
Shizhong Xu, Botany and Plant Sciences
Simon Groen, Assistant Professor, Nematology
Morris Maduro, Molecular, Cell, and Systems Biology
Anandasankar Ray, Molecular, Cell, and Systems Biology
Anupama Dahanukar, Molecular, Cell, and Systems Biology
Nicole zur Neiden, Molecular, Cell, and Systems Biology
Sihem Cheloufi, Molecular, Cell, and Systems Biology
Kieran Samuk, EEOB (primary for BIOL108)
Maria Ninova, Biochemistry (primary for BCH188)
Pavani Jannalagadda, Psychology (primary for PSYC 178 F23)
Ansel Hsiao, Microbiology and Plant Pathology (primary for BIOL 121)
Martin Riccomagno, Molecular, Cell, and Systems Biology (primary for CBNS121)
Alexander Raikhel, Entomology (primary for ENTM 111)
Prudence Talbot, Molecular, Cell, and Systems Biology (primary CBNS 169)
Fedor Karginov, Molecular, Cell, and Systems Biology
Frances Sladek, Molecular, Cell, and Systems Biology

Alan Brelsford, Entomology, (primary for BIOL118)

Plant Pathology - likely more people possible but hard to discern based on Dept website

EEOB

MCSB - likely more people possible but hard to discern based on Dept website

Biochemistry - possibly more people possible but hard to discern based on Dept website

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.*

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 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.*

   *need to contact **EEOB**, **CHEM**, **PHYS**, **STAT**, **MATH**, **BCH**, CBNS, ENTM, **PLPA**, **PSYC**, MCBL, NEM programs (bold have required courses, the others have electives; doesn't hurt to ask all)*

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 develop four core courses for the Genetics and Biotechnology major (GNBT010, GNBT 100, GNBT 110, and GNBT 114) that are required for degree completion in all three tracks of the major (Genetics and Genomics, Medical Genetics or Pre-Genetic Counseling, and 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 of the six 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.

TA support: Each of the six proposed GNBT courses 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 GNBT010 is an introductory course that will be accessible to students from other colleges, it has the potential to attract large enrollment. 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.*

    seek from…

    internal

    Joel Sachs, EEOB

    Morris Maduro, MCSB

    David Cocker

    external (not necessarily chairs)

    UW Madison, Francisco Pelligri https://genetics.wisc.edu/staff/pelegri-francisco/

    UGA, Mike Arnold

    KGI??

    UC Davis, Leslie Rose, Stacey Harmer, Sundar.. Neelima Sinha.

    UC Berkeley

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. COURSE CATALOG DESCRIPTIONS

1. Lower-division requirements (71-75 units)

a)

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

b)

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 bet- ter 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): con- current 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 bet- ter 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.

c)

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 mod- ern 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 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.

d)

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; concur- rent 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 experimen- tal 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 2HLB 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; colli- sions; 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; oscil- lations; 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.

e)

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. Prerequi- site(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. Prerequi- site(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.

f)

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.

g)

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.

BCH 110B General Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA with a grade of "C-" or better or consent of instructor. Consideration of metabolic pathways including mechanisms and regulation of catabolism, anabolism, and bioenergetics in living organisms. Credit is awarded for only one of BCH 110B or BCH 110HB.

h)

(proposed) 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.

2. Upper-division requirements (40-42 units)

a) Major core (20 units)

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 8HLC; 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 ap- plications to molecular medicine. Credit is not awarded for BCH 110HC if it has already been awarded for BCH 110C or BIOL 107A.

(proposed) 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.

(proposed) 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.

(proposed) 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.

b) Other requirements and electives (inclusive of all tracks)

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 107B Advanced Molecular Biology 3 Lecture, 2 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 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.

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.

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.

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.

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.

BPSC 104 Foundations of Plant Biology 4 Lecture, 3 hours; laboratory, 3 hours. Prerequi- site(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 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 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.

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 ENSC 134.

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 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 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 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 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 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.

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.

(proposed) 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.

(proposed) GNBT130 Introduction to Genomes 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.

(proposed) 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.

(proposed) 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.

ENTM 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 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.

MCBL 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 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 133 Environmental Microbiology 4 Lecture, 3 hours, discussion, 1 hour. Prereq- uisite(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.

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.

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 ENSC 120.

NEM 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 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 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 concur- rently; 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.

PSYC 179 Health and Behavior Change 4 Lecture, 3 hours; discussion, 1 hour; term paper, 1 hour. Prerequisite(s): PSYC 002 with a grade of C- or better or PSYC 178 with a grade of C- or better. Examines psychological constructs in health behavior change. Covers theories and research on preventive health behavior; adherence to treatment; health lifestyles; substance use and abuse; and anxiety and depression in medical illness. Also examines cognitive and behavioral techniques; helping skills; placebo effect; social support; therapeutic communication; medical care; and ethical issues.

APPENDIX II. NEW COURSE PROPOSALS

Worksheet - Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Level:

◯ Undergraduate 001 -199

◯ Graduate 200 -299

◯ Professional 300 -499

Subject: The subject code has to be approved and available in Banner

GNBT

Course number (if known). Only courses that have been discontinued for 3 or more years can be used as a new course or find a course number that has not been used.

010

Course Long Title: Maximum length is 100 characters. The students will see the long title in the Schedule of Classes. No slashes (/,\) or dashes (-) allowed.

Genetics and Society

Course Short Title: Maximum length is 30 characters. The students will have this title listed on their transcripts. This title will also appear in SSASECT. No slashes (/,\) or dashes (-) allowed.

Genetics and Society

Course Type:

☑ Standard Course

☐ Standard Course with Topics

☐ Umbrella with title in description

☐ umbrella without title in description

☐ E-Z segment (segment is not listed within the umbrella description)

Effective term: (Quarter and Year). Review the Academic Senate Courses web site .
Once a course is approved it can be offered any term.

Fall 2024

Offered in Summer only: A course can be offered in any term as long as it is approved.

☐ Yes

☐ No

Offered Once:

☐ Yes

☑ No

UNITS AND ACTIVITIES:

OVERALL UNITS: Enter in Fixed (4 units) or Variable (1 to 4 units) Units.

4

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems. Use the schedule type "Activity" to describe an activity that is not listed.
• One unit for each two to three hours per week (1:2-3) of studio

---

Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

Activity	Field	Research individual	Term Paper

Clinic	Internship	Research Scheduled	Thesis

Colloquium	Individual Study	Screening Individual	Tutorial

Consultation	Laboratory	Screening Scheduled	Workshop

Discussion	Lecture	Seminar	Written Work
1	3		

Extra Reading	Practicum	Studio

Cross-listing with: List all cross-listed partners.

Course Prerequisite Information: There are multiple types of Prerequisites that are acceptable. Please review all.

Corequisite: A corequisite is a course that is 100% concurrent enrollment for both proposals. Both proposals will have each other's course listed here. Multiple corequisites cannot be listed here. Only one course can be consider a corequisite area in CRS.

none

Prerequisite(s): A prerequisite must be an active course. In this section you will also decide if the prerequisite requires a minimum grade and if the course may be taken concurrently or if the course is only a prerequisite.

none

Other Prerequisite(s): Enter additional prerequisite information that will display in the Catalog. Example: "or equivalent" ;

BIOL 005A is recommended

Major Restrictions: Indicate the Major restriction(s) for this course. List the Major codes of the restriction here; Example: Education, Society, Human Dev – (ESHD)

none

Class Standing Restriction: If your course is a graduate course you do not need to select any of the following if your course prerequisite is the minimum of "graduate standing or consent of instructor". If your course is a course that undergraduate and graduate students can enroll in then you will select class information here.

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Credential
- ☐ Masters

Other Restrictions: List any special required restriction; Example: "a sufficiently high score on the placement examination, as determined by the Mathematics Department"

Special Requirements: Enter special requirements that will display in the Catalog Description. Example: "permission by faculty". This special requirement is enforced by the department and not the Registrar Office during registration.

Prerequisite Information Continued.

Consent of Instructor: Use the selection below to indicate that the course requires consent of instructor. The department is responsible for enforcement of “and consent of instructor.” Or “or consent of instructor”: For all courses 200 and above, the selection of "OR" is required. The department is responsible for enforcement of this restriction. Select one of the following if you want “consent of instructor” to appear with in the description within the general catalog.

◯ AND

◯ OR

Description Information:

Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.
Examples:
Instead of "This course will introduce students to the history of . . . ," use one of the following formats:
Introduces the history of . . .
An introduction to the history of . . .
Introduction to the history of . . .
Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
Explores functions, equations, and graphs . . .
Topics include functions, equations, and graphs . . .
A study of functions, equations, and graphs . . .

For "New" courses that will only be offered online the description must include "Offered online only." at the end of the description and included in the 50 word limit.

Catalog description:

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

Grading: Please see the General Rules and Polices Governing Courses of Instruction. Select the grade type that is in accordance with the guidelines.

- [x] Letter Grade or petition for Satisfactory/No Credit (S/NC) (undergraduate course default type).
- [ ] Letter Grade or S/NC, no petition required (Not per policy for undergraduate courses).
- [ ] Letter Grade only (graduate course default type).
- [ ] S/NC only
- [ ] In Progress (IP)

Grading Statement (if required)- Select the approved grading statement per grade types from the General Rules and Policies Governing Courses of Instruction. Select the grading statement that corresponds to the Grading Type per policy.

- ◯ Satisfactory (S) or No Credit (NC) grading is not available.
- ◯ Graded Satisfactory (S) or No Credit (NC).
- ◯ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
- ◯ May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
- ◯ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
- ◯ Students who submit a term paper receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar or submit a term paper receive a letter grade, other students receive a Satisfactory (S)or No Credit (NC) grade.

Course is Repeatable: Review the General Rules and Policies Governing Courses of Instruction to determine if your course can be considered to be repeatable.

- ◯ Yes
- ◯ No

Repeatability Statement: If you selected "Yes" for this course to be repeatable, you must enter a statement and follow the General Rules and Policies Governing Courses of Instruction for repeatable courses.

- ◯ Course is repeatable
- ◯ Course is repeatable as topic/content changes

Repeatable units: Enter the amount of repeatable units.

If repeatable, may the student take more that one section of the course in a single quarter?

◯ Yes

◯ No

Credit Overlap: Bi-directional (on both proposals) Bi-directional (on both proposals) **Example: "Credit is awarded for only one of ANTH 007 or ANTH 007S."** Provide in the course subject and numbers.

Credit Overlap: One directional (on one proposal only), or is a sequential course and is enforced by the department. **Example: "Credit is awarded for only one of the following sequences: CHN 001, CHN 002, CHN 003, and CHN 004; CHN 001, CHN 002, and CHN 020B; CHN 020A and CHN 020B."**

Credit Overlap: (students can get credit for both courses but there is overlap). Provide/describe the overlap. Also provide the justification for one-directional, bi-directional, and if students can get credit for both in this field.

Syllabus Information:

Syllabus: Provide a syllabus for a New or Restore course. Attach to an email or enter here. Please see the Faculty Checklist on page three to help with your syllabus

Syllabus: This new course proposal is for online and in-person instruction. The syllabus for the online and in-person section are the same?

◯ Yes

◯ No

Online Course Information: Select the appropriate only course information

- ☐ UCR Only
- ☐ ILTI/UCOP Funded (cross-campus enrolling; seats coordinated with UCOP)
- ☐ MSOL
- ☐ Undergraduate
- ☐ Graduate

BREADTH REQUIREMENT STATEMENTS

To change the breadth requirement information included on the college Breadth websites for please provide a memo to the course proposal requesting the course be considered Breadth. Select one of the statements below or provide a statement to correspond to breadth attributes. The memo will be entered into CRS in the attachments area. A comment will be entered into the comments field stating that a memo has been attached for consideration for a breadth course.

Select one of the following and attach the memo to CRS attachments

- ☐ Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences for breadth requirement information.
- ☐ Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

Other breadth statement

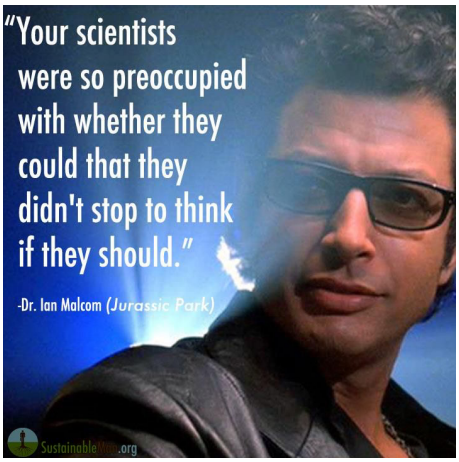
ADDITIONAL INFORMATION
For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at **http://senate.ucr.edu/committee/8**

Justification for the New Course

Introduces lower division undergraduates to current genetics and biotechnology advances, potentially attracting students to related careers and the GNBT major. Could satisfy science req for CHASS

MMiller updated 11/04/2022

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.

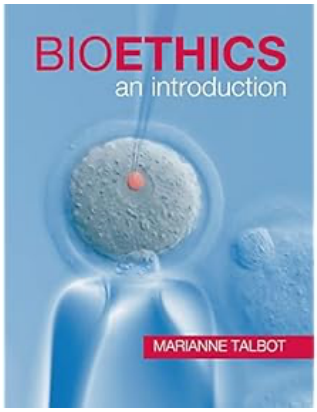
Reading. Reading assignments will include popular news articles, case studies, and texts on bioethics. In some cases, videos/film will be used to supplement readings.

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
Week 1	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	
Week 2	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)" https://www.genome.gov/about-genomics/educational-resources/timelines/eugenics Bioethics Ch. 9 (p. 139-158) "Reproductive freedom: rights, responsibilities, and choice"
Week 3	Genetic determinism and genetic risk	Niccol, Andrew. (1997). "Gattaca". *Columbia Pictures*
	Genetic testing and genome sequencing technologies	
Week 4	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". *Scientific American* Bioethics Ch. 18 (p. 348-370), "Bio-ownership: who owns the stuff of life?"
Week 5	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	
Week 6	Soft eugenics - *in vitro* fertilization, embryonic selection, prenatal sequencing	Zhang, Sarah. (2020). "The Last Children of Down Syndrome". *The Atlantic* Bioethics Ch. 11 (p. 181-202) "Screening and embryonic selection: eliminating disorders or people?"
	Changing reproduction - three-parent babies and *in vitro* gametogenesis	Cohen et al. (2017). "Disruptive reproductive technologies" *Science* Stein, Rob. (2023). "Creating a sperm or egg from any cell? Reproduction revolution on the horizon". *NPR. https://www.npr.org/sections/health-shots/2023/05/27/1177191913/sperm-or-egg-in-lab-breakthrough-in-reproduction-designer-babies-ivg*
Week 7	Genome editing technologies	Bioethics Ch. 14 (p. 251-272), "Human enhancement: the more the better?"
	Gene therapies	
Week 8	Cell replacement therapies	
	Embryonic stem cells and xenotransplantation	Bioethics Ch. 8 (p. 116-136), "Therapeutic cloning: the moral status of embryos"
Week 9	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"
Week 10	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 https://doi.org/10.1017/ext.2023.4

Worksheet - Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Level:

- (•) Undergraduate 001 -199
- ( ) Graduate 200 -299
- ( ) Professional 300 -499

Subject: The subject code has to be approved and available in Banner

GNBT

Course number (if known). Only courses that have been discontinued for 3 or more years can be used as a new course or find a course number that has not been used.

100

Course Long Title: Maximum length is 100 characters. The students will see the long title in the Schedule of Classes. No slashes (/,\) or dashes (-) allowed.

Introduction to Biotechnology: From Cloning to Synthetic Biology

Course Short Title: Maximum length is 30 characters. The students will have this title listed on their transcripts. This title will also appear in SSASECT. No slashes (/,\) or dashes (-) allowed.

Introduction to Biotechnology

Course Type:

- [x] Standard Course
- [ ] Standard Course with Topics
- [ ] Umbrella with title in description
- [ ] umbrella without title in description
- [ ] E-Z segment (segment is not listed within the umbrella description)

Effective term: (Quarter and Year). Review the Academic Senate Courses web site .
Once a course is approved it can be offered any term.

F2024

Offered in Summer only: A course can be offered in any term as long as it is approved.

- [ ] Yes
- [x] No

Offered Once:

☐ Yes
☑ No

UNITS AND ACTIVITIES:

OVERALL UNITS: Enter in Fixed (4 units) or Variable (1 to 4 units) Units.

4

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems. Use the schedule type "Activity" to describe an activity that is not listed.
• One unit for each two to three hours per week (1:2-3) of studio

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Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

Activity	Field	Research individual	Term Paper

Clinic	Internship	Research Scheduled	Thesis

Colloquium	Individual Study	Screening Individual	Tutorial

Consultation	Laboratory	Screening Scheduled	Workshop

Discussion	Lecture	Seminar	Written Work
1	3		

Extra Reading	Practicum	Studio

Cross-listing with: List all cross-listed partners.

Course Prerequisite Information: There are multiple types of Prerequisites that are acceptable. Please review all.

Corequisite: A corequisite is a course that is 100% concurrent enrollment for both proposals. Both proposals will have each other's course listed here. Multiple corequisites cannot be listed here. Only one course can be consider a corequisite area in CRS.

Prerequisite(s): A prerequisite must be an active course. In this section you will also decide if the prerequisite requires a minimum grade and if the course may be taken concurrently or if the course is only a prerequisite.

BIOL102

Other Prerequisite(s): Enter additional prerequisite information that will display in the Catalog. Example: "or equivalent" ;

or equivalent

Major Restrictions: Indicate the Major restriction(s) for this course. List the Major codes of the restriction here; Example: Education, Society, Human Dev – (ESHD)

Class Standing Restriction: If your course is a graduate course you do not need to select any of the following if your course prerequisite is the minimum of "graduate standing or consent of instructor". If your course is a course that undergraduate and graduate students can enroll in then you will select class information here.

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Credential
- ☐ Masters

Other Restrictions: List any special required restriction; Example: "a sufficiently high score on the placement examination, as determined by the Mathematics Department"

Special Requirements: Enter special requirements that will display in the Catalog Description. Example: "permission by faculty". This special requirement is enforced by the department and not the Registrar Office during registration.

Prerequisite Information Continued.

Consent of Instructor: Use the selection below to indicate that the course requires consent of instructor. The department is responsible for enforcement of “and consent of instructor.” Or “or consent of instructor”: For all courses 200 and above, the selection of "OR" is required. The department is responsible for enforcement of this restriction. Select one of the following if you want “consent of instructor” to appear with in the description within the general catalog.

◯ AND

◉ OR

Description Information:

Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.
Examples:
Instead of "This course will introduce students to the history of . . . ," use one of the following formats:
Introduces the history of . . .
An introduction to the history of . . .
Introduction to the history of . . .
Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
Explores functions, equations, and graphs . . .
Topics include functions, equations, and graphs . . .
A study of functions, equations, and graphs . . .

For "New" courses that will only be offered online the description must include "Offered online only." at the end of the description and included in the 50 word limit.

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),

Grading: Please see the General Rules and Polices Governing Courses of Instruction. Select the grade type that is in accordance with the guidelines.

- [x] Letter Grade or petition for Satisfactory/No Credit (S/NC) (undergraduate course default type).
- [ ] Letter Grade or S/NC, no petition required (Not per policy for undergraduate courses).
- [ ] Letter Grade only (graduate course default type).
- [ ] S/NC only
- [ ] In Progress (IP)

Grading Statement (if required)- Select the approved grading statement per grade types from the General Rules and Policies Governing Courses of Instruction. Select the grading statement that corresponds to the Grading Type per policy.

- (●) Satisfactory (S) or No Credit (NC) grading is not available.
- ( ) Graded Satisfactory (S) or No Credit (NC).
- ( ) Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
- ( ) May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
- ( ) May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
- ( ) Students who submit a term paper receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ( ) Students who present a seminar receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ( ) Students who present a seminar or submit a term paper receive a letter grade, other students receive a Satisfactory (S)or No Credit (NC) grade.

Course is Repeatable: Review the General Rules and Policies Governing Courses of Instruction to determine if your course can be considered to be repeatable.

- ( ) Yes
- (●) No

Repeatability Statement: If you selected "Yes" for this course to be repeatable, you must enter a statement and follow the General Rules and Policies Governing Courses of Instruction for repeatable courses.

- (●) Course is repeatable
- ( ) Course is repeatable as topic/content changes

Repeatable units: Enter the amount of repeatable units.

[ ]

If repeatable, may the student take more that one section of the course in a single quarter?

◯ Yes

◉ No

Credit Overlap: Bi-directional (on both proposals) Bi-directional (on both proposals) **Example: "Credit is awarded for only one of ANTH 007 or ANTH 007S."** Provide in the course subject and numbers.

Credit Overlap: One directional (on one proposal only), or is a sequential course and is enforced by the department. **Example: "Credit is awarded for only one of the following sequences: CHN 001, CHN 002, CHN 003, and CHN 004; CHN 001, CHN 002, and CHN 020B; CHN 020A and CHN 020B."**

Credit Overlap: (students can get credit for both courses but there is overlap). Provide/describe the overlap. Also provide the justification for one-directional, bi-directional, and if students can get credit for both in this field.

Syllabus Information:

Syllabus: Provide a syllabus for a New or Restore course. Attach to an email or enter here. Please see the Faculty Checklist on page three to help with your syllabus

Syllabus: This new course proposal is for online and in-person instruction. The syllabus for the online and in-person section are the same?

◯ Yes

◉ No

Online Course Information: Select the appropriate only course information

- ☐ UCR Only
- ☐ ILTI/UCOP Funded (cross-campus enrolling; seats coordinated with UCOP)
- ☐ MSOL
- ☐ Undergraduate
- ☐ Graduate

BREADTH REQUIREMENT STATEMENTS

To change the breadth requirement information included on the college Breadth websites for please provide a memo to the course proposal requesting the course be considered Breadth. Select one of the statements below or provide a statement to correspond to breadth attributes. The memo will be entered into CRS in the attachments area. A comment will be entered into the comments field stating that a memo has been attached for consideration for a breadth course.

Select one of the following and attach the memo to CRS attachments

- ☐ Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences for breadth requirement information.
- ☑ Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

Other breadth statement

ADDITIONAL INFORMATION
For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at **http://senate.ucr.edu/committee/8**

Justification for the New Course

UCR does not currently have a comprehensive class of biotechnology, a growing area of the biological workforce and an area of increasingly important scholarship. This course will be a core

MMiller updated 11/04/2022

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

Worksheet - Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Level:

- (•) Undergraduate 001 -199
- ( ) Graduate 200 -299
- ( ) Professional 300 -499

Subject: The subject code has to be approved and available in Banner

GNBT

Course number (if known). Only courses that have been discontinued for 3 or more years can be used as a new course or find a course number that has not been used.

110

Course Long Title: Maximum length is 100 characters. The students will see the long title in the Schedule of Classes. No slashes (/,\) or dashes (-) allowed.

Advanced Genetics

Course Short Title: Maximum length is 30 characters. The students will have this title listed on their transcripts. This title will also appear in SSASECT. No slashes (/,\) or dashes (-) allowed.

Advanced Genetics

Course Type:

- [x] Standard Course
- [ ] Standard Course with Topics
- [ ] Umbrella with title in description
- [ ] umbrella without title in description
- [ ] E-Z segment (segment is not listed within the umbrella description)

Effective term: (Quarter and Year). Review the Academic Senate Courses web site .
Once a course is approved it can be offered any term.

Fall 2024

Offered in Summer only: A course can be offered in any term as long as it is approved.

- [ ] Yes
- [x] No

Offered Once:

☐ Yes
☑ No

UNITS AND ACTIVITIES:

OVERALL UNITS: Enter in Fixed (4 units) or Variable (1 to 4 units) Units.

4

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems. Use the schedule type "Activity" to describe an activity that is not listed.
• One unit for each two to three hours per week (1:2-3) of studio

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Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

Activity	Field	Research individual	Term Paper

Clinic	Internship	Research Scheduled	Thesis

Colloquium	Individual Study	Screening Individual	Tutorial

Consultation	Laboratory	Screening Scheduled	Workshop

Discussion	Lecture	Seminar	Written Work
1	3		

Extra Reading	Practicum	Studio

Cross-listing with: List all cross-listed partners.

Course Prerequisite Information: There are multiple types of Prerequisites that are acceptable. Please review all.

Corequisite: A corequisite is a course that is 100% concurrent enrollment for both proposals. Both proposals will have each other's course listed here. Multiple corequisites cannot be listed here. Only one course can be consider a corequisite area in CRS.

Prerequisite(s): A prerequisite must be an active course. In this section you will also decide if the prerequisite requires a minimum grade and if the course may be taken concurrently or if the course is only a prerequisite.

BIOL102, with a grade of "C-" or better

Other Prerequisite(s): Enter additional prerequisite information that will display in the Catalog. Example: "or equivalent" ;

Major Restrictions: Indicate the Major restriction(s) for this course. List the Major codes of the restriction here; Example: Education, Society, Human Dev – (ESHD)

Class Standing Restriction: If your course is a graduate course you do not need to select any of the following if your course prerequisite is the minimum of "graduate standing or consent of instructor". If your course is a course that undergraduate and graduate students can enroll in then you will select class information here.

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Credential
- ☐ Masters

Other Restrictions: List any special required restriction; Example: "a sufficiently high score on the placement examination, as determined by the Mathematics Department"

Special Requirements: Enter special requirements that will display in the Catalog Description. Example: "permission by faculty". This special requirement is enforced by the department and not the Registrar Office during registration.

Prerequisite Information Continued.

Consent of Instructor: Use the selection below to indicate that the course requires consent of instructor. The department is responsible for enforcement of “and consent of instructor.” Or “or consent of instructor”: For all courses 200 and above, the selection of "OR" is required. The department is responsible for enforcement of this restriction. Select one of the following if you want “consent of instructor” to appear with in the description within the general catalog.

◯ AND

◉ OR

Description Information:

Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.
Examples:
Instead of "This course will introduce students to the history of . . . ," use one of the following formats:
Introduces the history of . . .
An introduction to the history of . . .
Introduction to the history of . . .
Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
Explores functions, equations, and graphs . . .
Topics include functions, equations, and graphs . . .
A study of functions, equations, and graphs . . .

For "New" courses that will only be offered online the description must include "Offered online only." at the end of the description and included in the 50 word limit.

Catalog description:

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

Grading: Please see the General Rules and Polices Governing Courses of Instruction. Select the grade type that is in accordance with the guidelines.

- [x] Letter Grade or petition for Satisfactory/No Credit (S/NC) (undergraduate course default type).
- [ ] Letter Grade or S/NC, no petition required (Not per policy for undergraduate courses).
- [ ] Letter Grade only (graduate course default type).
- [ ] S/NC only
- [ ] In Progress (IP)

Grading Statement (if required)- Select the approved grading statement per grade types from the General Rules and Policies Governing Courses of Instruction. Select the grading statement that corresponds to the Grading Type per policy.

- ◯ Satisfactory (S) or No Credit (NC) grading is not available.
- ◯ Graded Satisfactory (S) or No Credit (NC).
- ◯ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
- ◯ May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
- ◯ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
- ◯ Students who submit a term paper receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar or submit a term paper receive a letter grade, other students receive a Satisfactory (S)or No Credit (NC) grade.

Course is Repeatable: Review the General Rules and Policies Governing Courses of Instruction to determine if your course can be considered to be repeatable.

- ◯ Yes
- ◉ No

Repeatability Statement: If you selected "Yes" for this course to be repeatable, you must enter a statement and follow the General Rules and Policies Governing Courses of Instruction for repeatable courses.

- ◯ Course is repeatable
- ◯ Course is repeatable as topic/content changes

Repeatable units: Enter the amount of repeatable units.

If repeatable, may the student take more that one section of the course in a single quarter?

- ◯ Yes
- ◯ No

Credit Overlap: Bi-directional (on both proposals) Bi-directional (on both proposals) **Example: "Credit is awarded for only one of ANTH 007 or ANTH 007S."** Provide in the course subject and numbers.

Credit Overlap: One directional (on one proposal only), or is a sequential course and is enforced by the department. **Example: "Credit is awarded for only one of the following sequences: CHN 001, CHN 002, CHN 003, and CHN 004; CHN 001, CHN 002, and CHN 020B; CHN 020A and CHN 020B."**

Credit Overlap: (students can get credit for both courses but there is overlap). Provide/describe the overlap. Also provide the justification for one-directional, bi-directional, and if students can get credit for both in this field.

Syllabus Information:

Syllabus: Provide a syllabus for a New or Restore course. Attach to an email or enter here. Please see the Faculty Checklist on page three to help with your syllabus

Syllabus: This new course proposal is for online and in-person instruction. The syllabus for the online and in-person section are the same?

- ◉ Yes
- ◯ No

Online Course Information: Select the appropriate only course information

- [x] UCR Only
- [ ] ILTI/UCOP Funded (cross-campus enrolling; seats coordinated with UCOP)
- [ ] MSOL
- [ ] Undergraduate
- [ ] Graduate

BREADTH REQUIREMENT STATEMENTS

To change the breadth requirement information included on the college Breadth websites for please provide a memo to the course proposal requesting the course be considered Breadth. Select one of the statements below or provide a statement to correspond to breadth attributes. The memo will be entered into CRS in the attachments area. A comment will be entered into the comments field stating that a memo has been attached for consideration for a breadth course.

Select one of the following and attach the memo to CRS attachments

- [ ] Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences for breadth requirement information.
- [ ] Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

Other breadth statement

ADDITIONAL INFORMATION
For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at **http://senate.ucr.edu/committee/8**

Justification for the New Course

This course is proposed as a core requirement for a new planned major in Genetics, Genomics and Biotechnology. It completes a three course series in genetics that includes Introductory Genetics and

MMiller updated 11/04/2022

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.

Worksheet - Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Level:

◯ Undergraduate 001 -199

◯ Graduate 200 -299

◯ Professional 300 -499

Subject: The subject code has to be approved and available in Banner

GNBT

Course number (if known). Only courses that have been discontinued for 3 or more years can be used as a new course or find a course number that has not been used.

114

Course Long Title: Maximum length is 100 characters. The students will see the long title in the Schedule of Classes. No slashes (/,\) or dashes (-) allowed.

Molecular Genetics Laboratory

Course Short Title: Maximum length is 30 characters. The students will have this title listed on their transcripts. This title will also appear in SSASECT. No slashes (/,\) or dashes (-) allowed.

Molecular Genetics Laboratory

Course Type:

☑ Standard Course

☐ Standard Course with Topics

☐ Umbrella with title in description

☐ umbrella without title in description

☐ E-Z segment (segment is not listed within the umbrella description)

Effective term: (Quarter and Year). Review the Academic Senate Courses web site .
Once a course is approved it can be offered any term.

Fall 2024

Offered in Summer only: A course can be offered in any term as long as it is approved.

☐ Yes

☑ No

Offered Once:

☐ Yes
☑ No

UNITS AND ACTIVITIES:

OVERALL UNITS: Enter in Fixed (4 units) or Variable (1 to 4 units) Units.

4

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems. Use the schedule type "Activity" to describe an activity that is not listed.
• One unit for each two to three hours per week (1:2-3) of studio

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Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

Activity	Field	Research individual	Term Paper

Clinic	Internship	Research Scheduled	Thesis

Colloquium	Individual Study	Screening Individual	Tutorial

Consultation	Laboratory	Screening Scheduled	Workshop
	6		

Discussion	Lecture	Seminar	Written Work
	2		

Extra Reading	Practicum	Studio

Cross-listing with: List all cross-listed partners.

Course Prerequisite Information: There are multiple types of Prerequisites that are acceptable. Please review all.

Corequisite: A corequisite is a course that is 100% concurrent enrollment for both proposals. Both proposals will have each other's course listed here. Multiple corequisites cannot be listed here. Only one course can be consider a corequisite area in CRS.

Prerequisite(s): A prerequisite must be an active course. In this section you will also decide if the prerequisite requires a minimum grade and if the course may be taken concurrently or if the course is only a prerequisite.

BIOL 102, with a grade of "C-" or better; BIOL 107A, may be taken concurrently

Other Prerequisite(s): Enter additional prerequisite information that will display in the Catalog. Example: "or equivalent" ;

Major Restrictions: Indicate the Major restriction(s) for this course. List the Major codes of the restriction here; Example: Education, Society, Human Dev – (ESHD)

Class Standing Restriction: If your course is a graduate course you do not need to select any of the following if your course prerequisite is the minimum of "graduate standing or consent of instructor". If your course is a course that undergraduate and graduate students can enroll in then you will select class information here.

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Credential
- ☐ Masters

Other Restrictions: List any special required restriction; Example: "a sufficiently high score on the placement examination, as determined by the Mathematics Department"

Special Requirements: Enter special requirements that will display in the Catalog Description. Example: "permission by faculty". This special requirement is enforced by the department and not the Registrar Office during registration.

Prerequisite Information Continued.

Consent of Instructor: Use the selection below to indicate that the course requires consent of instructor. The department is responsible for enforcement of “and consent of instructor.” Or “or consent of instructor”: For all courses 200 and above, the selection of "OR" is required. The department is responsible for enforcement of this restriction. Select one of the following if you want “consent of instructor” to appear with in the description within the general catalog.

◯ AND

◯ OR

Description Information:

Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.
Examples:
Instead of "This course will introduce students to the history of . . . ," use one of the following formats:
Introduces the history of . . .
An introduction to the history of . . .
Introduction to the history of . . .
Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
Explores functions, equations, and graphs . . .
Topics include functions, equations, and graphs . . .
A study of functions, equations, and graphs . . .

For "New" courses that will only be offered online the description must include "Offered online only." at the end of the description and included in the 50 word limit.

Catalog description:

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,

Grading: Please see the General Rules and Polices Governing Courses of Instruction. Select the grade type that is in accordance with the guidelines.

- [x] Letter Grade or petition for Satisfactory/No Credit (S/NC) (undergraduate course default type).
- [ ] Letter Grade or S/NC, no petition required (Not per policy for undergraduate courses).
- [ ] Letter Grade only (graduate course default type).
- [ ] S/NC only
- [ ] In Progress (IP)

Grading Statement (if required)- Select the approved grading statement per grade types from the General Rules and Policies Governing Courses of Instruction. Select the grading statement that corresponds to the Grading Type per policy.

- ◯ Satisfactory (S) or No Credit (NC) grading is not available.
- ◯ Graded Satisfactory (S) or No Credit (NC).
- ◯ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
- ◯ May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
- ◯ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
- ◯ Students who submit a term paper receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar or submit a term paper receive a letter grade, other students receive a Satisfactory (S)or No Credit (NC) grade.

Course is Repeatable: Review the General Rules and Policies Governing Courses of Instruction to determine if your course can be considered to be repeatable.

- ◯ Yes
- ◯ No

Repeatability Statement: If you selected "Yes" for this course to be repeatable, you must enter a statement and follow the General Rules and Policies Governing Courses of Instruction for repeatable courses.

- ◯ Course is repeatable
- ◯ Course is repeatable as topic/content changes

Repeatable units: Enter the amount of repeatable units.

If repeatable, may the student take more that one section of the course in a single quarter?

◯ Yes

◯ No

Credit Overlap: Bi-directional (on both proposals) Bi-directional (on both proposals) **Example: "Credit is awarded for only one of ANTH 007 or ANTH 007S."** Provide in the course subject and numbers.

Credit Overlap: One directional (on one proposal only), or is a sequential course and is enforced by the department. **Example: "Credit is awarded for only one of the following sequences: CHN 001, CHN 002, CHN 003, and CHN 004; CHN 001, CHN 002, and CHN 020B; CHN 020A and CHN 020B."**

Credit Overlap: (students can get credit for both courses but there is overlap). Provide/describe the overlap. Also provide the justification for one-directional, bi-directional, and if students can get credit for both in this field.

Syllabus Information:

Syllabus: Provide a syllabus for a New or Restore course. Attach to an email or enter here. Please see the Faculty Checklist on page three to help with your syllabus

Syllabus: This new course proposal is for online and in-person instruction. The syllabus for the online and in-person section are the same?

◯ Yes

◯ No

Online Course Information: Select the appropriate only course information

- ☐ UCR Only
- ☐ ILTI/UCOP Funded (cross-campus enrolling; seats coordinated with UCOP)
- ☐ MSOL
- ☐ Undergraduate
- ☐ Graduate

BREADTH REQUIREMENT STATEMENTS

To change the breadth requirement information included on the college Breadth websites for please provide a memo to the course proposal requesting the course be considered Breadth. Select one of the statements below or provide a statement to correspond to breadth attributes. The memo will be entered into CRS in the attachments area. A comment will be entered into the comments field stating that a memo has been attached for consideration for a breadth course.

Select one of the following and attach the memo to CRS attachments

- ☐ Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences for breadth requirement information.
- ☐ Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

Other breadth statement

ADDITIONAL INFORMATION
For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at **http://senate.ucr.edu/committee/8**

Justification for the New Course

This course is proposed as a core requirement for a new planned major in Genetics and Biotechnology. Upper-division biological labs are currently limited.

MMiller updated 11/04/2022

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: *Arabidopsis thaliana* example	Alternative *Arabidopsis thaliana* 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-DNAs, 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/insensitve 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 fluroescence dissecting microscope and take images, Introduce FIJI image analysis tools	Learn to use fluroescence dissecting microscope and take images, Introduce FIJI image analysis tools
4.1	**Exam 1**	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 - reveiw trangenic 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 mutagensis: RNAi, CRISPR-Cas9-mediated	Mol Exp. 4: Electrophoresis and analysis of miniprep digests	Analyze gravitropism data	Count LRs to assess LR capacity
8.1	**Exam 2**	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	**Exam 3/Final**		**Submit updated lab notebooks**	**Submit updated lab notebooks**
			*course can be adapted to use other organisms based on instructor's preference (e.g. *Drosophila melanogaster*, *Caenorhabditis elegans*)	

Worksheet - Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Level:

◯ Undergraduate 001 -199

◯ Graduate 200 -299

◯ Professional 300 -499

Subject: The subject code has to be approved and available in Banner

GNBT

Course number (if known). Only courses that have been discontinued for 3 or more years can be used as a new course or find a course number that has not been used.

120

Course Long Title: Maximum length is 100 characters. The students will see the long title in the Schedule of Classes. No slashes (/,\) or dashes (-) allowed.

Analysis of Genomes Laboratory

Course Short Title: Maximum length is 30 characters. The students will have this title listed on their transcripts. This title will also appear in SSASECT. No slashes (/,\) or dashes (-) allowed.

Analysis of Genomes Laboratory

Course Type:

☑ Standard Course

☐ Standard Course with Topics

☐ Umbrella with title in description

☐ umbrella without title in description

☐ E-Z segment (segment is not listed within the umbrella description)

Effective term: (Quarter and Year). Review the Academic Senate Courses web site .
Once a course is approved it can be offered any term.

Fall 2024

Offered in Summer only: A course can be offered in any term as long as it is approved.

☐ Yes

☑ No

Offered Once:

☐ Yes

☑ No

UNITS AND ACTIVITIES:

OVERALL UNITS: Enter in Fixed (4 units) or Variable (1 to 4 units) Units.

4

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems. Use the schedule type "Activity" to describe an activity that is not listed.
• One unit for each two to three hours per week (1:2-3) of studio

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Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

Activity	Field	Research individual	Term Paper

Clinic	Internship	Research Scheduled	Thesis

Colloquium	Individual Study	Screening Individual	Tutorial

Consultation	Laboratory	Screening Scheduled	Workshop
	6		

Discussion	Lecture	Seminar	Written Work
1	1		

Extra Reading	Practicum	Studio

Cross-listing with: List all cross-listed partners.

Course Prerequisite Information: There are multiple types of Prerequisites that are acceptable. Please review all.

Corequisite: A corequisite is a course that is 100% concurrent enrollment for both proposals. Both proposals will have each other's course listed here. Multiple corequisites cannot be listed here. Only one course can be consider a corequisite area in CRS.

Prerequisite(s): A prerequisite must be an active course. In this section you will also decide if the prerequisite requires a minimum grade and if the course may be taken concurrently or if the course is only a prerequisite.

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

Other Prerequisite(s): Enter additional prerequisite information that will display in the Catalog. Example: "or equivalent" ;

Major Restrictions: Indicate the Major restriction(s) for this course. List the Major codes of the restriction here; Example: Education, Society, Human Dev – (ESHD)

Class Standing Restriction: If your course is a graduate course you do not need to select any of the following if your course prerequisite is the minimum of "graduate standing or consent of instructor". If your course is a course that undergraduate and graduate students can enroll in then you will select class information here.

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Credential
- ☐ Masters

Other Restrictions: List any special required restriction; Example: "a sufficiently high score on the placement examination, as determined by the Mathematics Department"

Special Requirements: Enter special requirements that will display in the Catalog Description. Example: "permission by faculty". This special requirement is enforced by the department and not the Registrar Office during registration.

Prerequisite Information Continued.

Consent of Instructor: Use the selection below to indicate that the course requires consent of instructor. The department is responsible for enforcement of “and consent of instructor.” Or “or consent of instructor”: For all courses 200 and above, the selection of "OR" is required. The department is responsible for enforcement of this restriction. Select one of the following if you want “consent of instructor” to appear with in the description within the general catalog.

◯ AND

◯ OR

Description Information:

Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.
Examples:
Instead of "This course will introduce students to the history of . . . ," use one of the following formats:
Introduces the history of . . .
An introduction to the history of . . .
Introduction to the history of . . .
Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
Explores functions, equations, and graphs . . .
Topics include functions, equations, and graphs . . .
A study of functions, equations, and graphs . . .

For "New" courses that will only be offered online the description must include "Offered online only." at the end of the description and included in the 50 word limit.

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

Grading: Please see the General Rules and Polices Governing Courses of Instruction. Select the grade type that is in accordance with the guidelines.

- [x] Letter Grade or petition for Satisfactory/No Credit (S/NC) (undergraduate course default type).
- [ ] Letter Grade or S/NC, no petition required (Not per policy for undergraduate courses).
- [ ] Letter Grade only (graduate course default type).
- [ ] S/NC only
- [ ] In Progress (IP)

Grading Statement (if required)- Select the approved grading statement per grade types from the General Rules and Policies Governing Courses of Instruction. Select the grading statement that corresponds to the Grading Type per policy.

- ◯ Satisfactory (S) or No Credit (NC) grading is not available.
- ◯ Graded Satisfactory (S) or No Credit (NC).
- ◯ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
- ◯ May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
- ◯ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
- ◯ Students who submit a term paper receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar or submit a term paper receive a letter grade, other students receive a Satisfactory (S)or No Credit (NC) grade.

Course is Repeatable: Review the General Rules and Policies Governing Courses of Instruction to determine if your course can be considered to be repeatable.

- ◯ Yes
- ◯ No

Repeatability Statement: If you selected "Yes" for this course to be repeatable, you must enter a statement and follow the General Rules and Policies Governing Courses of Instruction for repeatable courses.

- ◯ Course is repeatable
- ◯ Course is repeatable as topic/content changes

Repeatable units: Enter the amount of repeatable units.

If repeatable, may the student take more that one section of the course in a single quarter?

◯ Yes

◯ No

Credit Overlap: Bi-directional (on both proposals) Bi-directional (on both proposals) **Example: "Credit is awarded for only one of ANTH 007 or ANTH 007S."** Provide in the course subject and numbers.

Credit Overlap: One directional (on one proposal only), or is a sequential course and is enforced by the department. **Example: "Credit is awarded for only one of the following sequences: CHN 001, CHN 002, CHN 003, and CHN 004; CHN 001, CHN 002, and CHN 020B; CHN 020A and CHN 020B."**

Credit Overlap: (students can get credit for both courses but there is overlap). Provide/describe the overlap. Also provide the justification for one-directional, bi-directional, and if students can get credit for both in this field.

Syllabus Information:

Syllabus: Provide a syllabus for a New or Restore course. Attach to an email or enter here. Please see the Faculty Checklist on page three to help with your syllabus

Syllabus: This new course proposal is for online and in-person instruction. The syllabus for the online and in-person section are the same?

◯ Yes

◯ No

Online Course Information: Select the appropriate only course information

- ☐ UCR Only
- ☐ ILTI/UCOP Funded (cross-campus enrolling; seats coordinated with UCOP)
- ☐ MSOL
- ☐ Undergraduate
- ☐ Graduate

BREADTH REQUIREMENT STATEMENTS

To change the breadth requirement information included on the college Breadth websites for please provide a memo to the course proposal requesting the course be considered Breadth. Select one of the statements below or provide a statement to correspond to breadth attributes. The memo will be entered into CRS in the attachments area. A comment will be entered into the comments field stating that a memo has been attached for consideration for a breadth course.

Select one of the following and attach the memo to CRS attachments

- ☐ Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences for breadth requirement information.
- ☑ Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

Other breadth statement

ADDITIONAL INFORMATION
For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at **http://senate.ucr.edu/committee/8**

Justification for the New Course

Laboratory course to introduce Biology focused students to key computational concepts. Part of a new proposed major.

MMiller updated 11/04/2022

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. Preform 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	

Worksheet - Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Level:

- (•) Undergraduate 001 -199
- ( ) Graduate 200 -299
- ( ) Professional 300 -499

Subject: The subject code has to be approved and available in Banner

GNBT

Course number (if known). Only courses that have been discontinued for 3 or more years can be used as a new course or find a course number that has not been used.

130

Course Long Title: Maximum length is 100 characters. The students will see the long title in the Schedule of Classes. No slashes (/,\) or dashes (-) allowed.

Introduction to Genomes: from microbes to plants to human

Course Short Title: Maximum length is 30 characters. The students will have this title listed on their transcripts. This title will also appear in SSASECT. No slashes (/,\) or dashes (-) allowed.

Introduction to Genomes

Course Type:

- [x] Standard Course
- [ ] Standard Course with Topics
- [ ] Umbrella with title in description
- [ ] umbrella without title in description
- [ ] E-Z segment (segment is not listed within the umbrella description)

Effective term: (Quarter and Year). Review the Academic Senate Courses web site .
Once a course is approved it can be offered any term.

F2024

Offered in Summer only: A course can be offered in any term as long as it is approved.

- [ ] Yes
- [x] No

Offered Once:

☐ Yes
☑ No

UNITS AND ACTIVITIES:

OVERALL UNITS: Enter in Fixed (4 units) or Variable (1 to 4 units) Units.

4

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems. Use the schedule type "Activity" to describe an activity that is not listed.
• One unit for each two to three hours per week (1:2-3) of studio

---

Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

Activity	Field	Research individual	Term Paper

Clinic	Internship	Research Scheduled	Thesis

Colloquium	Individual Study	Screening Individual	Tutorial

Consultation	Laboratory	Screening Scheduled	Workshop

Discussion	Lecture	Seminar	Written Work
1	3		

Extra Reading	Practicum	Studio

Cross-listing with: List all cross-listed partners.

Course Prerequisite Information: There are multiple types of Prerequisites that are acceptable. Please review all.

Corequisite: A corequisite is a course that is 100% concurrent enrollment for both proposals. Both proposals will have each other's course listed here. Multiple corequisites cannot be listed here. Only one course can be consider a corequisite area in CRS.

Prerequisite(s): A prerequisite must be an active course. In this section you will also decide if the prerequisite requires a minimum grade and if the course may be taken concurrently or if the course is only a prerequisite.

BIOL 102

Other Prerequisite(s): Enter additional prerequisite information that will display in the Catalog. Example: "or equivalent" ;

Major Restrictions: Indicate the Major restriction(s) for this course. List the Major codes of the restriction here; Example: Education, Society, Human Dev – (ESHD)

Class Standing Restriction: If your course is a graduate course you do not need to select any of the following if your course prerequisite is the minimum of "graduate standing or consent of instructor". If your course is a course that undergraduate and graduate students can enroll in then you will select class information here.

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Credential
- ☐ Masters

Other Restrictions: List any special required restriction; Example: "a sufficiently high score on the placement examination, as determined by the Mathematics Department"

Special Requirements: Enter special requirements that will display in the Catalog Description. Example: "permission by faculty". This special requirement is enforced by the department and not the Registrar Office during registration.

Prerequisite Information Continued.

Consent of Instructor: Use the selection below to indicate that the course requires consent of instructor. The department is responsible for enforcement of “and consent of instructor.” Or “or consent of instructor”: For all courses 200 and above, the selection of "OR" is required. The department is responsible for enforcement of this restriction. Select one of the following if you want “consent of instructor” to appear with in the description within the general catalog.

◯ AND

◯ OR

Description Information:

Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.
Examples:
Instead of "This course will introduce students to the history of . . . ," use one of the following formats:
Introduces the history of . . .
An introduction to the history of . . .
Introduction to the history of . . .
Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
Explores functions, equations, and graphs . . .
Topics include functions, equations, and graphs . . .
A study of functions, equations, and graphs . . .

For "New" courses that will only be offered online the description must include "Offered online only." at the end of the description and included in the 50 word limit.

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.

Grading: Please see the General Rules and Polices Governing Courses of Instruction. Select the grade type that is in accordance with the guidelines.

- [x] Letter Grade or petition for Satisfactory/No Credit (S/NC) (undergraduate course default type).
- [ ] Letter Grade or S/NC, no petition required (Not per policy for undergraduate courses).
- [ ] Letter Grade only (graduate course default type).
- [ ] S/NC only
- [ ] In Progress (IP)

Grading Statement (if required)- Select the approved grading statement per grade types from the General Rules and Policies Governing Courses of Instruction. Select the grading statement that corresponds to the Grading Type per policy.

- ◯ Satisfactory (S) or No Credit (NC) grading is not available.
- ◯ Graded Satisfactory (S) or No Credit (NC).
- ◯ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
- ◯ May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
- ◯ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
- ◯ Students who submit a term paper receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar or submit a term paper receive a letter grade, other students receive a Satisfactory (S)or No Credit (NC) grade.

Course is Repeatable: Review the General Rules and Policies Governing Courses of Instruction to determine if your course can be considered to be repeatable.

- ◯ Yes
- ◉ No

Repeatability Statement: If you selected "Yes" for this course to be repeatable, you must enter a statement and follow the General Rules and Policies Governing Courses of Instruction for repeatable courses.

- ◯ Course is repeatable
- ◯ Course is repeatable as topic/content changes

Repeatable units: Enter the amount of repeatable units.

If repeatable, may the student take more that one section of the course in a single quarter?

◯ Yes

◯ No

Credit Overlap: Bi-directional (on both proposals) Bi-directional (on both proposals) **Example: "Credit is awarded for only one of ANTH 007 or ANTH 007S."** Provide in the course subject and numbers.

Credit Overlap: One directional (on one proposal only), or is a sequential course and is enforced by the department. **Example: "Credit is awarded for only one of the following sequences: CHN 001, CHN 002, CHN 003, and CHN 004; CHN 001, CHN 002, and CHN 020B; CHN 020A and CHN 020B."**

Credit Overlap: (students can get credit for both courses but there is overlap). Provide/describe the overlap. Also provide the justification for one-directional, bi-directional, and if students can get credit for both in this field.

Syllabus Information:

Syllabus: Provide a syllabus for a New or Restore course. Attach to an email or enter here. Please see the Faculty Checklist on page three to help with your syllabus

Syllabus: This new course proposal is for online and in-person instruction. The syllabus for the online and in-person section are the same?

◯ Yes

◯ No

Online Course Information: Select the appropriate only course information

- ☐ UCR Only
- ☐ ILTI/UCOP Funded (cross-campus enrolling; seats coordinated with UCOP)
- ☐ MSOL
- ☐ Undergraduate
- ☐ Graduate

BREADTH REQUIREMENT STATEMENTS

To change the breadth requirement information included on the college Breadth websites for please provide a memo to the course proposal requesting the course be considered Breadth. Select one of the statements below or provide a statement to correspond to breadth attributes. The memo will be entered into CRS in the attachments area. A comment will be entered into the comments field stating that a memo has been attached for consideration for a breadth course.

Select one of the following and attach the memo to CRS attachments

- ☐ Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- ☐ See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences for breadth requirement information.
- ☐ Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

Other breadth statement

ADDITIONAL INFORMATION
For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at **http://senate.ucr.edu/committee/8**

Justification for the New Course

Course is needed for new major in Genetics and Biotechnology. It fills a current gap in UCR coursework concerning how genomes in different kingdoms of life are composed and evolve.

MMiller updated 11/04/2022

Course title
GNBT 130: Introduction to Genomes: from microbes to plants to human

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. Front Genet 14: 1150212. (2) Hayward, A., Gilbert C (2022) Primer: transposable elements. Curr Biol. 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. Ann Rev Virol. 10: 49-75. (2) Caetano-Anolles, G., Claverie, J-M, Nasir, A. (2023) A critical analysis of the current state of virus taxonomy. Front in Micro 14: 1240993.
Week 4	Bacterial Genomes	(1) Kirchberger PC, Schmidt, Ochman (2020) The ingenuity of bacterial genomes. Ann Rev Micro 74: 815-834.

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

Worksheet - Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Level:

- (•) Undergraduate 001 -199
- ( ) Graduate 200 -299
- ( ) Professional 300 -499

Subject: The subject code has to be approved and available in Banner

GNBT

Course number (if known). Only courses that have been discontinued for 3 or more years can be used as a new course or find a course number that has not been used.

197

Course Long Title: Maximum length is 100 characters. The students will see the long title in the Schedule of Classes. No slashes (/,\) or dashes (-) allowed.

Research For Undergraduates

Course Short Title: Maximum length is 30 characters. The students will have this title listed on their transcripts. This title will also appear in SSASECT. No slashes (/,\) or dashes (-) allowed.

Research For Undergraduates

Course Type:

- [x] Standard Course
- [ ] Standard Course with Topics
- [ ] Umbrella with title in description
- [ ] umbrella without title in description
- [ ] E-Z segment (segment is not listed within the umbrella description)

Effective term: (Quarter and Year). Review the Academic Senate Courses web site .
Once a course is approved it can be offered any term.

Fall 2024

Offered in Summer only: A course can be offered in any term as long as it is approved.

- [ ] Yes
- [ ] No

Offered Once:

☐ Yes
☑ No

UNITS AND ACTIVITIES:

OVERALL UNITS: Enter in Fixed (4 units) or Variable (1 to 4 units) Units.

1 to 4 units

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems. Use the schedule type "Activity" to describe an activity that is not listed.
• One unit for each two to three hours per week (1:2-3) of studio

---

Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

Activity	Field	Research individual	Term Paper
		3 to 12 hours	

Clinic	Internship	Research Scheduled	Thesis

Colloquium	Individual Study	Screening Individual	Tutorial

Consultation	Laboratory	Screening Scheduled	Workshop

Discussion	Lecture	Seminar	Written Work

Extra Reading	Practicum	Studio

Cross-listing with: List all cross-listed partners.

Course Prerequisite Information: There are multiple types of Prerequisites that are acceptable. Please review all.

Corequisite: A corequisite is a course that is 100% concurrent enrollment for both proposals. Both proposals will have each other's course listed here. Multiple corequisites cannot be listed here. Only one course can be consider a corequisite area in CRS.

Prerequisite(s): A prerequisite must be an active course. In this section you will also decide if the prerequisite requires a minimum grade and if the course may be taken concurrently or if the course is only a prerequisite.

upper-division standing

Other Prerequisite(s): Enter additional prerequisite information that will display in the Catalog. Example: "or equivalent" ;

Major Restrictions: Indicate the Major restriction(s) for this course. List the Major codes of the restriction here; Example: Education, Society, Human Dev – (ESHD)

Class Standing Restriction: If your course is a graduate course you do not need to select any of the following if your course prerequisite is the minimum of "graduate standing or consent of instructor". If your course is a course that undergraduate and graduate students can enroll in then you will select class information here.

- ☐ Freshman
- ☐ Sophomore
- ☑ Junior
- ☑ Senior
- ☐ Credential
- ☐ Masters

Other Restrictions: List any special required restriction; Example: "a sufficiently high score on the placement examination, as determined by the Mathematics Department"

Special Requirements: Enter special requirements that will display in the Catalog Description. Example: "permission by faculty". This special requirement is enforced by the department and not the Registrar Office during registration.

Prerequisite Information Continued.

Consent of Instructor: Use the selection below to indicate that the course requires consent of instructor. The department is responsible for enforcement of “and consent of instructor.” Or “or consent of instructor”: For all courses 200 and above, the selection of "OR" is required. The department is responsible for enforcement of this restriction. Select one of the following if you want “consent of instructor” to appear with in the description within the general catalog.

- (●) AND
- ( ) OR

Description Information:

Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.
Examples:
Instead of "This course will introduce students to the history of . . . ," use one of the following formats:
Introduces the history of . . .
An introduction to the history of . . .
Introduction to the history of . . .
Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
Explores functions, equations, and graphs . . .
Topics include functions, equations, and graphs . . .
A study of functions, equations, and graphs . . .

For "New" courses that will only be offered online the description must include "Offered online only." at the end of the description and included in the 50 word limit.

Catalog description:

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

Grading: Please see the General Rules and Polices Governing Courses of Instruction. Select the grade type that is in accordance with the guidelines.

- ☐ Letter Grade or petition for Satisfactory/No Credit (S/NC) (undergraduate course default type).
- ☐ Letter Grade or S/NC, no petition required (Not per policy for undergraduate courses).
- ☑ Letter Grade only (graduate course default type).
- ☐ S/NC only
- ☐ In Progress (IP)

Grading Statement (if required)- Select the approved grading statement per grade types from the General Rules and Policies Governing Courses of Instruction. Select the grading statement that corresponds to the Grading Type per policy.

- ◯ Satisfactory (S) or No Credit (NC) grading is not available.
- ◯ Graded Satisfactory (S) or No Credit (NC).
- ◯ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
- ◯ May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
- ◯ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
- ◯ Students who submit a term paper receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
- ◯ Students who present a seminar or submit a term paper receive a letter grade, other students receive a Satisfactory (S)or No Credit (NC) grade.

Course is Repeatable: Review the General Rules and Policies Governing Courses of Instruction to determine if your course can be considered to be repeatable.

- ◉ Yes
- ◯ No

Repeatability Statement: If you selected "Yes" for this course to be repeatable, you must enter a statement and follow the General Rules and Policies Governing Courses of Instruction for repeatable courses.

- ◉ Course is repeatable
- ◯ Course is repeatable as topic/content changes

Repeatable units: Enter the amount of repeatable units.

up to 4 units total

If repeatable, may the student take more that one section of the course in a single quarter?

- ◯ Yes
- ◉ No

Credit Overlap: Bi-directional (on both proposals) Bi-directional (on both proposals) **Example: "Credit is awarded for only one of ANTH 007 or ANTH 007S."** Provide in the course subject and numbers.

Credit Overlap: One directional (on one proposal only), or is a sequential course and is enforced by the department. **Example: "Credit is awarded for only one of the following sequences: CHN 001, CHN 002, CHN 003, and CHN 004; CHN 001, CHN 002, and CHN 020B; CHN 020A and CHN 020B."**

Credit Overlap: (students can get credit for both courses but there is overlap). Provide/describe the overlap. Also provide the justification for one-directional, bi-directional, and if students can get credit for both in this field.

Syllabus Information:

Syllabus: Provide a syllabus for a New or Restore course. Attach to an email or enter here. Please see the Faculty Checklist on page three to help with your syllabus

This course provides research opportunities/experiences for upper division GNBT

Syllabus: This new course proposal is for online and in-person instruction. The syllabus for the online and in-person section are the same?

- ◉ Yes
- ◯ No

Online Course Information: Select the appropriate only course information

- [x] UCR Only
- [ ] ILTI/UCOP Funded (cross-campus enrolling; seats coordinated with UCOP)
- [ ] MSOL
- [x] Undergraduate
- [ ] Graduate

BREADTH REQUIREMENT STATEMENTS

To change the breadth requirement information included on the college Breadth websites for please provide a memo to the course proposal requesting the course be considered Breadth. Select one of the statements below or provide a statement to correspond to breadth attributes. The memo will be entered into CRS in the attachments area. A comment will be entered into the comments field stating that a memo has been attached for consideration for a breadth course.

Select one of the following and attach the memo to CRS attachments

- [ ] Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences for breadth requirement information.
- [x] Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

Other breadth statement

ADDITIONAL INFORMATION
For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at **http://senate.ucr.edu/committee/8**

Justification for the New Course

Like other “197-type courses” within CNAS, this course will provide research

MMiller updated 11/04/2022

Syllabus for GNBT 197 Research For Undergraduates (1 to 4 units)

Catalog description

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.

Detailed description

This course provides research opportunities/experiences for upper division GNBT undergraduates in labs of faculty members of the program. GNBT majors will be able to choose mentors for GNBT197 activities from GNBT program faculty. Upon consultation with the respective faculty mentor, the student will design a research-focused project that serves the educational goals of the GNBT program and the track chosen by the student. Per unit taken, three hours of lab work are required. The student will write a short project proposal (e.g. 1 page), which has to be approved by the faculty mentor and needs to be submitted to the GNBT undergraduate advisor by the beginning of the respective quarter. Under supervision by the faculty mentor (possibly assisted by other lab members, e.g. graduate students, SRAs or post-docs) the student will perform the planned research activities during the quarter. In some cases the research activity may be exclusively of theoretical nature and can be performed in a “remote” manner, if both faculty mentor and student agree on this. By the end of the quarter, the student has to provide a written scientific report about the performed work. The faculty mentor will advise the student on the expected format and content of this report and has to approve this report. The report will have to be submitted to the GNBT undergraduate advisor before the end of finals week of a given quarter. The faculty advisor will provide a letter grade based on the student’s performance, proposal and research report.

Justification

Like other “197-type courses” within CNAS, this course will provide research opportunities/experiences for upper division GNBT undergraduates in labs of faculty members of the program. It will provide students with the flexibility to chose research opportunities that match their own educational and professional goals within the context of GNBT program-related research. Research internships, like GNBT 197 activities, provide students with valuable insight into authentic research and help them to decide what future career paths to pursue.

Worksheet - Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text, **
or use an X or a number to fill in “check-box” or numbered fields.

Level:

- (●) Undergraduate 001 -199
- ( ) Graduate 200 -299
- ( ) Professional 300 -499

Subject: The subject code has to be approved and available in Banner

GNBT

Course number (if known). Only courses that have been discontinued for 3 or more years can be used as a new course or find a course number that has not been used.

199

Course Long Title: Maximum length is 100 characters. The students will see the long title in the Schedule of Classes. No slashes (/,\) or dashes (-) allowed.

Senior Research

Course Short Title: Maximum length is 30 characters. The students will have this title listed on their transcripts. This title will also appear in SSASECT. No slashes (/,\) or dashes (-) allowed.

Senior Research

Course Type:

- [x] Standard Course
- [ ] Standard Course with Topics
- [ ] Umbrella with title in description
- [ ] umbrella without title in description
- [ ] E-Z segment (segment is not listed within the umbrella description)

Effective term: (Quarter and Year). Review the Academic Senate Courses web site .
Once a course is approved it can be offered any term.

Fall 2024

Offered in Summer only: A course can be offered in any term as long as it is approved.

- [ ] Yes
- [x] No

Offered Once:

☐ Yes
☑ No

UNITS AND ACTIVITIES:

OVERALL UNITS: Enter in Fixed (4 units) or Variable (1 to 4 units) Units.

2 to 4 units

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop
• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems. Use the schedule type "Activity" to describe an activity that is not listed.
• One unit for each two to three hours per week (1:2-3) of studio

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Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

Activity	Field	Research individual	Term Paper
		6 to 12 hours	

Clinic	Internship	Research Scheduled	Thesis

Colloquium	Individual Study	Screening Individual	Tutorial

Consultation	Laboratory	Screening Scheduled	Workshop

Discussion	Lecture	Seminar	Written Work

Extra Reading	Practicum	Studio

Cross-listing with: List all cross-listed partners.

Course Prerequisite Information: There are multiple types of Prerequisites that are acceptable. Please review all.

Corequisite: A corequisite is a course that is 100% concurrent enrollment for both proposals. Both proposals will have each other's course listed here. Multiple corequisites cannot be listed here. Only one course can be consider a corequisite area in CRS.

Prerequisite(s): A prerequisite must be an active course. In this section you will also decide if the prerequisite requires a minimum grade and if the course may be taken concurrently or if the course is only a prerequisite.

Senior status; a GPA of 3.2 or better in upper-division

Other Prerequisite(s): Enter additional prerequisite information that will display in the Catalog. Example: "or equivalent" ;

Major Restrictions: Indicate the Major restriction(s) for this course. List the Major codes of the restriction here; Example: Education, Society, Human Dev – (ESHD)

Class Standing Restriction: If your course is a graduate course you do not need to select any of the following if your course prerequisite is the minimum of "graduate standing or consent of instructor". If your course is a course that undergraduate and graduate students can enroll in then you will select class information here.

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☑ Senior
- ☐ Credential
- ☐ Masters

Other Restrictions: List any special required restriction; Example: "a sufficiently high score on the placement examination, as determined by the Mathematics Department"

Special Requirements: Enter special requirements that will display in the Catalog Description. Example: "permission by faculty". This special requirement is enforced by the department and not the Registrar Office during registration.

Prerequisite Information Continued.

Consent of Instructor: Use the selection below to indicate that the course requires consent of instructor. The department is responsible for enforcement of “and consent of instructor.” Or “or consent of instructor”: For all courses 200 and above, the selection of "OR" is required. The department is responsible for enforcement of this restriction. Select one of the following if you want “consent of instructor” to appear with in the description within the general catalog.

◯ AND

◉ OR

Description Information:

Read the guidelines in this box before writing the Catalog description.
Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.
Examples:
Instead of "This course will introduce students to the history of . . . ," use one of the following formats:
Introduces the history of . . .
An introduction to the history of . . .
Introduction to the history of . . .
Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
Explores functions, equations, and graphs . . .
Topics include functions, equations, and graphs . . .
A study of functions, equations, and graphs . . .

For "New" courses that will only be offered online the description must include "Offered online only." at the end of the description and included in the 50 word limit.

Catalog description:

Individual research on a problem relating to GNBT program goals. A written proposal signed by the

Grading: Please see the General Rules and Polices Governing Courses of Instruction. Select the grade type that is in accordance with the guidelines.

- ☐ Letter Grade or petition for Satisfactory/No Credit (S/NC) (undergraduate course default type).
- ☐ Letter Grade or S/NC, no petition required (Not per policy for undergraduate courses).
- ☑ Letter Grade only (graduate course default type).
- ☐ S/NC only
- ☐ In Progress (IP)

Grading Statement (if required)- Select the approved grading statement per grade types from the General Rules and Policies Governing Courses of Instruction. Select the grading statement that corresponds to the Grading Type per policy.

- ◯ Satisfactory (S) or No Credit (NC) grading is not available.
- ◯ Graded Satisfactory (S) or No Credit (NC).
- ◯ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
- ◯ May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
- ◯ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
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- ◯ Students who present a seminar receive a letter grade, other students receive a Satisfactory (S) or No Credit (NC) grade.
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Course is Repeatable: Review the General Rules and Policies Governing Courses of Instruction to determine if your course can be considered to be repeatable.

- ◉ Yes
- ◯ No

Repeatability Statement: If you selected "Yes" for this course to be repeatable, you must enter a statement and follow the General Rules and Policies Governing Courses of Instruction for repeatable courses.

- ◉ Course is repeatable
- ◯ Course is repeatable as topic/content changes

Repeatable units: Enter the amount of repeatable units.

Course is repeatable, but total credit toward gra

If repeatable, may the student take more that one section of the course in a single quarter?

- ◯ Yes
- ◉ No

Credit Overlap: Bi-directional (on both proposals) Bi-directional (on both proposals) **Example: "Credit is awarded for only one of ANTH 007 or ANTH 007S."** Provide in the course subject and numbers.

Credit Overlap: One directional (on one proposal only), or is a sequential course and is enforced by the department. **Example: "Credit is awarded for only one of the following sequences: CHN 001, CHN 002, CHN 003, and CHN 004; CHN 001, CHN 002, and CHN 020B; CHN 020A and CHN 020B."**

Credit Overlap: (students can get credit for both courses but there is overlap). Provide/describe the overlap. Also provide the justification for one-directional, bi-directional, and if students can get credit for both in this field.

Syllabus Information:

Syllabus: Provide a syllabus for a New or Restore course. Attach to an email or enter here. Please see the Faculty Checklist on page three to help with your syllabus

This course provides advanced research opportunities/experiences for senior GNBT

Syllabus: This new course proposal is for online and in-person instruction. The syllabus for the online and in-person section are the same?

- ◉ Yes
- ◯ No

Online Course Information: Select the appropriate only course information

- [x] UCR Only
- [ ] ILTI/UCOP Funded (cross-campus enrolling; seats coordinated with UCOP)
- [ ] MSOL
- [x] Undergraduate
- [ ] Graduate

BREADTH REQUIREMENT STATEMENTS

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Select one of the following and attach the memo to CRS attachments

- [ ] Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- [ ] See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences for breadth requirement information.
- [x] Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

Other breadth statement

ADDITIONAL INFORMATION
For further information about course guidelines, see the General Rules and Policies Governing Courses of Instruction at **http://senate.ucr.edu/committee/8**

Justification for the New Course

Like other “199-type courses” within CNAS, this course will provide advanced research

MMiller updated 11/04/2022

Syllabus for GNBT 199 Senior Research 2 to 4

Catalog description

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.

Detailed description

This course provides advanced research opportunities/experiences for senior GNBT undergraduates in labs of faculty members of the program. GNBT seniors will be able to choose mentors for GNBT199 activities from GNBT program faculty. Upon consultation with the respective faculty mentor, the student will design an advanced research-focused project that serves the educational goals of the GNBT program and the track chosen by the student. Per unit taken, three hours of lab work are required. The student will write a short project proposal (e.g. 1 page), which has to be approved by the faculty mentor and needs to be submitted to the GNBT undergraduate advisor by the beginning of the respective quarter. Under supervision by the faculty mentor (possibly assisted by other lab members, e.g. graduate students, SRAs or post-docs) the student will perform the planned research activities during the quarter. In some cases the research activity may be exclusively of theoretical nature and can be performed in a "remote" manner, if both faculty mentor and student agree on this. By the end of the quarter, the student has to provide a written scientific report about the performed work. The faculty mentor will advise the student on the expected format and content of this report and has to approve this report. The report will have to be submitted to the GNBT undergraduate advisor before the end of finals week of a given quarter. The faculty advisor will provide a letter grade based on the student's performance, proposal and research report.

Justification

Like other "199-type courses" within CNAS, this course will provide advanced research opportunities/experiences for upper division GNBT undergraduates in labs of faculty members of the program. It will provide students with the flexibility to chose research opportunities that match their own educational and professional goals within the context of GNBT program-related research. Advanced research internships, like GNBT 199 activities, provide students with valuable insight into authentic research and help them to decide what future career paths to pursue. Successful performance on GNBT 199 projects will help prepare students for the transition to graduate school, other post-graduate programs or science-related professional activities.