

BIOLOGICAL SCIENCES (BIS)

College of Biological Sciences

BIS 002A – Introduction to Biology: Essentials of Life on Earth (5 units)

Course Description: Essentials of life including sources and use of energy, information storage, responsiveness to natural selection and cellularity. Origin of life and influence of living things on the chemistry of the Earth. May be taught abroad.

Prerequisite(s): CHE 002A or CHE 004A or equivalent recommended.

Learning Activities: Lecture 3 hour(s), Discussion 2 hour(s).

Credit Limitation(s): Not open for credit to students who have completed BIS 001A with a grade of C- or better.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

BIS 002B – Introduction to Biology: Principles of Ecology & Evolution (5 units)

Course Description: Introduction to basic principles of ecology and evolutionary biology, focusing on the fundamental mechanisms that generate and maintain biological diversity across scales ranging from molecules and genes to global processes and patterns. May be taught abroad.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s), Laboratory 3 hour(s).

Credit Limitation(s): Not open for credit to students who have completed BIS 001B with a grade of C- or better.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL); Visual Literacy (VL).

BIS 002C – Introduction to Biology: Biodiversity & the Tree of Life (5 units)

Course Description: Introduction to organismal diversity, using the phylogenetic tree of life as an organizing theme. Lectures and laboratories cover methods of phylogenetic reconstruction, current knowledge of the tree of life, and the evolution of life's most important and interesting innovations. May be taught abroad.

Prerequisite(s): BIS 001B C- or better or BIS 002B C- or better.

Learning Activities: Lecture 4 hour(s), Laboratory 3 hour(s).

Credit Limitation(s): Not open for credit to students who have completed BIS 001C with a grade of C- or better.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Oral Skills (OL); Quantitative Literacy (QL); Scientific Literacy (SL); Visual Literacy (VL).

BIS 002D – Introduction to Biology: Principles of Cell Biology & Physiology (3 units)

Course Description: Introduction to the essential principles underlying cellular organization and function, how the properties of cells give rise to complex cellular behaviors that contribute to tissue organization/function and the physiological paradigms that govern complex life.

Prerequisite(s): BIS 002A C- or better.

Learning Activities: Lecture 3 hour(s).

Credit Limitation(s): Not open for credit to students who have taken BIS 104 and NPB 110A.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

BIS 005 – Exploring Biological Sciences (1 unit)

Course Description: Introduction to biology at UC Davis through discussions with faculty and speakers from industry and medicine.

Learning Activities: Seminar 1 hour(s).

Enrollment Restriction(s): Enrollment limited to first year College of Biological Sciences students.

Grade Mode: Pass/No Pass only.

BIS 006 – BioLaunch: Career Pathways Seminar (1.5 units)

Course Description: Exploration of diverse career options, building professional networks, transferable skills, and developing materials and strategies for landing relevant experiential learning opportunities in the biological sciences fields.

Prerequisite(s): BIS 005; or consent of instructor.

Learning Activities: Discussion 1.5 hour(s).

Grade Mode: P/NP only.

BIS 010 – Everyday Biology (4 units)

Course Description: Everyday biological concepts using contemporary readings for non-scientists. Key topics include: personal genomics; food & health; climate & evolution; brain biology & the law. Innovative projects apply biological concepts to current events. For students not specializing in biology.

Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).

Credit Limitation(s): Not open for credit to students who have completed BIS 002A or NEM 010V or equivalent.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Scientific Literacy (SL).

BIS 011 – Issues in the Life Sciences (2 units)

Course Description: The range of subjects and approaches in the field of biology, including both basic and applied research topics.

Prerequisite(s): Consent of instructor. Enrollment limited to BUSP students.

Learning Activities: Lecture 1 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

BIS 011L – Basic Life Sciences Laboratory (1 unit)

Course Description: Basic laboratory skills in life sciences research, including microbiology, molecular biology, and genetics.

Prerequisite(s): Consent of instructor.

Learning Activities: Laboratory 3 hour(s).

Enrollment Restriction(s): Limited to Biology Undergraduate Scholars Program (BUSP) students.

Grade Mode: Letter.

BIS 015L – Introduction to Data Science for Biologists (2 units)

Course Description: Introduction to data science with a focus on developing practical computational skills for biologists. Data management, transformation, visualization, and analysis using R. Fundamentals of the UNIX shell including navigation and automation. Computational resources for biologists with emphasis on the management of genomic data.

Learning Activities: Lecture 1 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

BIS 020Q – Modeling in Biology (2 units)

Course Description: Introduction to the application of quantitative methods to biological problems. Use a mathematical software package to tackle problems drawn from all aspects of biology.

Prerequisite(s): MAT 016B C- or better (can be concurrent) or MAT 017B C- or better (can be concurrent) or MAT 021B C- or better (can be concurrent) or MAT 021BH C- or better (can be concurrent).

Learning Activities: Lecture 1 hour(s), Discussion 1 hour(s).

Grade Mode: Letter.

BIS 023A – Genome Hunters (3 units)

Course Description: Hands-on, project-based introduction to genome-centric biology with specific focus on quantitative elements of associated experimental approaches. Measurement error and error estimation, experimental design, data analysis, model generation and fitting, and model-guided hypothesis generation and testing. Content covered through quarter-long interactive experiment to isolate an organism, quantitatively characterize its behavior, and sequence its genome.

Prerequisite(s): MAT 017A (can be concurrent) or MAT 021A (can be concurrent).

Learning Activities: Lecture 1 hour(s), Laboratory 3 hour(s), Extensive Problem Solving.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

BIS 023B – Genome Hunters (3 units)

Course Description: Hands-on, project-based introduction to modern computational and bioinformatics analyses using genome sequence data generated in BIS 023A. Genome sequence assembly and alignment, genome annotation, and genetic correlates of behavior. Additional topics may include scientific and societal implications of the availability and usage of genome information and genome manipulation, and real-life applications of genome analysis.

Prerequisite(s): BIS 023A; MAT 017B (can be concurrent) or MAT 021B (can be concurrent).

Learning Activities: Lecture 1 hour(s), Laboratory 3 hour(s), Extensive Problem Solving.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Visual Literacy (VL).

BIS 027A – Linear Algebra with Applications to Biology (4 units)

Course Description: Introduction to linear algebra with biological, medical, and bioengineering applications. Matrix algebra, vector spaces, orthogonality, determinants, eigenvalues, eigenvectors, principal component analysis, singular value decomposition, and linear transformations. Computer labs cover mathematical and computational techniques for modeling biological systems.

Prerequisite(s): MAT 017C C- or better or MAT 021C C- or better or MAT 021CH C- or better.

Learning Activities: Lecture 3 hour(s), Laboratory 2 hour(s).

Credit Limitation(s): Only 1 unit of credit for students who have completed MAT 022A.

Cross Listing: MAT 027A.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

BIS 027B – Differential Equations with Applications to Biology (4 units)

Course Description: Solutions of differential equations with biological, medical, and bioengineering applications. First and second order linear equations, phase plane analysis, nonlinear dynamics, Laplace transforms, and the diffusion equation. Computer labs cover mathematical and numerical techniques for modeling biological systems.

Prerequisite(s): (BIS 027A C- or better or MAT 027A C- or better) or (MAT 022A C- or better, (MAT 022AL C- or better or ENG 006 C- or better or ECS 032A C- or better or ECS 036A C- or better or ECH 060 C- or better or EME 005 C- or better)).

Learning Activities: Lecture 3 hour(s), Laboratory 2 hour(s).

Credit Limitation(s): Only 1 unit of credit for students who have completed MAT 022B.

Cross Listing: MAT 027B.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

BIS 060 – BioLaunch: Career Laboratory (2 units)

Course Description: Interactive, simulated activities that demonstrate day-to-day work in a variety of careers facilitated by professionals in industries related to Biological Sciences.

Prerequisite(s): BIS 005 P or better; BIS 006 P or better; or consent of instructor.

Learning Activities: Discussion/Laboratory 2 hour(s).

Enrollment Restriction(s): Open to College of Biological Sciences students only.

Grade Mode: P/NP only.

BIS 092 – Internship in Biological Sciences (1-12 units)

Course Description: Internship in Biological Sciences.

Prerequisite(s): Consent of instructor; lower division standing.

Learning Activities: Internship 3-36 hour(s).

Enrollment Restriction(s): Restricted to lower division standing.

Grade Mode: Pass/No Pass only.

BIS 098 – Directed Group Study (1-5 units)

Course Description: Primarily for lower division students.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

BIS 099 – Special Study for Undergraduates (1-5 units)

Course Description: Special study for undergraduates.

Prerequisite(s): Consent of instructor; lower division standing.

Learning Activities: Independent Study 3-15 hour(s).

Enrollment Restriction(s): Restricted to lower division standing.

Grade Mode: Pass/No Pass only.

BIS 101 – Genes & Gene Expression (4 units)

Course Description: Nucleic acid structure and function; gene expression and its regulation; replication; transcription and translation; transmission genetics; molecular evolution. May be taught abroad.

Prerequisite(s): (BIS 002A C- or better, BIS 002B C- or better); (CHE 008A or CHE 118A or CHE 128A); ((STA 013 or STA 013Y) or STA 100 or STA 102 or STA 130A)); STA 100 preferred.

Learning Activities: Lecture 4 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL).

BIS 101D – Genes & Gene Expression Discussion (1 unit)

Course Description: Discussion and problem solving related to fundamental principles of classical and molecular genetics as presented in BIS 101.

Prerequisite(s): BIS 101 (can be concurrent); and consent of instructor.

Learning Activities: Discussion 1 hour(s).

Grade Mode: Pass/No Pass only.

BIS 102 – Structure & Function of Biomolecules (3 units)

Course Description: Structure and function of macromolecules with emphasis on proteins, catalysis, enzyme kinetics, lipids, membranes, and proteins as machines. May be taught abroad.

Prerequisite(s): (BIS 001A or BIS 002A); (CHE 008B or CHE 118B or CHE 128B).

Learning Activities: Lecture 3 hour(s).

Credit Limitation(s): Only 1 unit of credit for students who have completed ABI 102; only 1.5 units of credit for students who have completed BIS 105.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

BIS 103 – Bioenergetics & Metabolism (3 units)

Course Description: Fundamentals of the carbon, nitrogen, and sulfur cycles in nature, including key reactions of biomolecules such as carbohydrates, amino acids, lipids, and nucleotides, and of energy production and use in different types of organisms. Principles of metabolic regulation.

Prerequisite(s): BIS 102.

Learning Activities: Lecture 3 hour(s).

Credit Limitation(s): 1.5 units of credit for students who have completed BIS 105; 1 unit of credit if students who have completed ABI 103.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

BIS 104 – Cell Biology (3 units)

Course Description: Membrane receptors and signal transduction; cell trafficking; cell cycle; cell growth and division; extracellular matrix and cell-cell junctions; cell development; immune system.

Prerequisite(s): BIS 101; (BIS 102 or BIS 105 or ABI 102 C- or better).

Learning Activities: Lecture 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE).

BIS 105 – Biomolecules & Metabolism (3 units)

Course Description: Fundamentals of biochemical processes, with emphasis on protein structure and activity; energy metabolism; catabolism of sugars, amino acids, and lipids; and gluconeogenesis.

Prerequisite(s): BIS 002A; (CHE 008B or CHE 118B or CHE 128B).

Learning Activities: Lecture 3 hour(s).

Credit Limitation(s): 1.5 units of credit for students who have completed BIS 102 or BIS 103; no credit for students who have completed both BIS 102 and BIS 103; 1 unit of credit for students who have completed ABI 102 or ABI 103; no credit for students who have completed both ABI 102 and ABI 103.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL).

BIS 106 – BioLaunch: Experiential Learning Seminar (1 unit)

Course Description: Applied learning experience for self evaluation of a current or recent internship or research position. Analysis of workplace culture, identification of opportunities for professional growth, and useful lessons from peer experiences.

Prerequisite(s): BIS 005; BIS 006; BIS 060; or consent of instructor.

Learning Activities: Discussion 1 hour(s).

Enrollment Restriction(s): Open to College of Biological Sciences students only.

Grade Mode: P/NP only.

BIS 107 – Probability & Stochastic Processes with Applications to Biology (4 units)

Course Description: Introduction to probability theory and stochastic processes with biological, medical, and bioengineering applications. Combinatorics, discrete and continuous random variables, Bayes' formula, conditional probability, Markov chains, Poisson processes, and Brownian motion. Computer labs cover mathematical and computational modeling techniques.

Prerequisite(s): (BIS 027A C- or better or MAT 027A C- or better) or (MAT 022A C- or better, (MAT 022AL C- or better or ENG 006 C- or better or ECS 032A C- or better or ECS 036A C- or better or ECH 060 C- or better or EME 005 C- or better)).

Learning Activities: Lecture 3 hour(s), Laboratory 2 hour(s).

Credit Limitation(s): Only 2 units of credit for students who have completed MAT 135A or STA 131A.

Cross Listing: MAT 107.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

BIS 122 – Population Biology & Ecology (3 units)

Course Description: Biological and physical processes affecting plant and animal populations in the rich array of habitats at the Bodega Marine Laboratory ecological preserve. Emphasis on field experience, with complementing lectures to address population and community processes. See Bodega Marine Laboratory Program.

Prerequisite(s): (BIS 001A, BIS 001B, BIS 001C) or (BIS 002A, BIS 002B, BIS 002C); residence at Bodega Marine Laboratory required.

Learning Activities: Lecture 2 hour(s), Laboratory 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Oral Skills (OL); Quantitative Literacy (QL); Scientific Literacy (SL); Visual Literacy (VL); Writing Experience (WE).

BIS 122P – Population Biology & Ecology/Advanced Laboratory Topics (5 units)

Course Description: Training in scientific research, from hypothesis testing to publication, including methods of library research. Research will be related to a topic covered in BIS 122. Final presentation both oral and written. See Bodega Marine Laboratory Program.

Prerequisite(s): BIS 122 (can be concurrent).

Learning Activities: Laboratory 12 hour(s), Discussion 1 hour(s).

Enrollment Restriction(s): Residence at Bodega Marine Laboratory required.

Grade Mode: Letter.

General Education: Science & Engineering (SE); Visual Literacy (VL); Writing Experience (WE).

BIS 123 – Undergraduate Colloquium in Marine Science (1 unit)

Course Description: Series of weekly seminars by recognized authorities in various disciplines of marine science from within and outside the UC system. Includes informal discussion with speaker. Held at Bodega Marine Laboratory; see Bodega Marine Laboratory Program.

Prerequisite(s): Enrolled student at the Bodega Marine Laboratory.

Learning Activities: Seminar 1 hour(s).

Grade Mode: Pass/No Pass only.

BIS 124 – Coastal Marine Research (6 units)

Course Description: Independent research on topics related to an accompanying core Bodega Marine Laboratory summer course. Receive training in generating hypotheses, designing experiments, collecting and analyzing data, and scientific communication.

Prerequisite(s): (EVE 114 (can be concurrent) or EVE 106 (can be concurrent) or ESP 152 (can be concurrent) or ESP 124 (can be concurrent)); concurrent enrollment in one of the above listed courses required; upper division standing or consent of instructor.

Learning Activities: Laboratory 12 hour(s), Fieldwork 12 hour(s), Discussion/Laboratory 2 hour(s).

Enrollment Restriction(s): Student must complete the application at <http://www.bml.ucdavis.edu>.

Repeat Credit: May be repeated 2 time(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Oral Skills (OL); Quantitative Literacy (QL); Visual Literacy (VL); Writing Experience (WE).

BIS 133 – Collaborative Studies in Mathematical Biology (3 units)

Course Description: Interdisciplinary research and training that uses mathematics and computation to solve current problems in biology.

Prerequisite(s): MAT 016A; MAT 016B; MAT 016C; (BIS 001A or BIS 001B or BIS 001C or BIS 002A or BIS 002B or BIS 002C or BIS 010); and consent of instructor, or equivalents.

Learning Activities: Lecture/Discussion 3 hour(s).

Repeat Credit: May be repeated 6 time(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL); Visual Literacy (VL); Writing Experience (WE).

BIS 160 – BioLaunch: Career Next Step Seminar (1 unit)

Course Description: Preparation for the next step after undergraduate work at UC Davis with support from staff, faculty, and industry partners. Applications for careers, graduate and professional schools.

Prerequisite(s): BIS 005; BIS 006; BIS 060; BIS 106; or consent of instructor.

Learning Activities: Discussion 1 hour(s).

Enrollment Restriction(s): Open to College of Biological Sciences students only.

Grade Mode: Pass/No Pass only.

BIS 180L – Genomics Laboratory (5 units)

Course Description: Computational approaches to model and analyze biological information about genomes, transcriptomes, and proteomes. Topics include genome assembly and annotation, mRNA and small RNA profiling, proteomics, protein-DNA and protein-protein interactions, network analysis, and comparative genomics.

Prerequisite(s): BIS 015L; (BIS 181 or BIS 183 or MCB 182); or consent of instructor.

Learning Activities: Lecture 2 hour(s), Laboratory 6 hour(s), Discussion 1 hour(s).

Credit Limitation(s): Students who have received credit for taking BIT 150 will receive 3 units for completing BIS 180L.

Grade Mode: Letter.

General Education: Science & Engineering (SE).

BIS 181 – Comparative Genomics (3 units)

Course Description: Comparison of genomes at the population and species level. Genomic techniques for mapping disease (and other) genes, reconstruction of evolutionary history and migration patterns, determination of gene function, prediction of organismal traits, and metagenomics: determination of community composition and function.

Prerequisite(s): BIS 101 C- or better; or consent of instructor.

Learning Activities: Lecture 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Scientific Literacy (SL).

BIS 183 – Functional Genomics (3 units)

Course Description: Overview of genomic methodologies and key biological findings obtained using genome-wide analyses. RNA profiling, small RNAs, epigenomics, chromatin immunoprecipitation, protein-DNA interactions, proteomics and network analysis.

Prerequisite(s): BIS 101; (BIS 102 or BIS 105 recommended.)

Learning Activities: Lecture 3 hour(s).

Grade Mode: Letter.

General Education: Science & Engineering (SE); Quantitative Literacy (QL); Visual Literacy (VL).

BIS 185L – Systems & Synthetic Biology Lab (5 units)

Course Description: Principles & applications of systems and synthetic biology. Bistable & monostable switches, single cell sequencing, genetic circuits, design of biological parts and pathway modeling. Computational & experimental labs use single cell sequence data to determine switch types in cell identity, design and characterize promoter libraries and use genomics-enabled approaches to discover and characterize enzymes & metabolites.

Prerequisite(s): BIS 015L C- or better; BIS 134 C- or better (can be concurrent); BIM 143 C- or better (can be concurrent); or consent of instructor.

Learning Activities: Discussion 1 hour(s), Laboratory 6 hour(s), Lecture 2 hour(s).

Grade Mode: Letter.

BIS 192 – Internship in Biological Sciences (1-12 units)

Course Description: Internship in Biological Sciences.

Prerequisite(s): Consent of instructor; upper division standing.

Learning Activities: Internship 3-36 hour(s).

Grade Mode: Pass/No Pass only.

BIS 194H – Research Honors (2 units)

Course Description: Students majoring in Biological Sciences who have completed two quarters (3-5 units per quarter) of 199 and who qualify for the honors program as defined by the current catalog. Opportunity for Biological Sciences majors to pursue intensive research culminating in the writing of a senior thesis with the guidance of faculty advisors.

Prerequisite(s): Senior standing.

Learning Activities: Independent Study 6 hour(s).

Grade Mode: Pass/No Pass only.

General Education: Science & Engineering (SE); Writing Experience (WE).

BIS 195A – Science Teaching Internship Program (4 units)

Course Description: Basic teaching techniques including lesson planning, classroom management, and presentation skills. Interns spend time in K-12 science classrooms working with a master teacher observing, assisting with labs and activities, managing students, and teaching lessons.

Prerequisite(s): Upper division standing in a science major or consent of instructor.

Learning Activities: Lecture/Discussion 2 hour(s), Internship 6 hour(s).

Enrollment Restriction(s): Major in science; junior or senior status (based on units); application and interview; limited to 24 students.

Grade Mode: Pass/No Pass only.

BIS 195B – Science Teaching Internship (1-5 units)

Course Description: Reinforcement of teaching techniques learned in 195A with additional classroom experience in K-12 science classrooms working with a master teacher observing, assisting with labs and activities, managing students and teaching lessons.

Prerequisite(s): BIS 195A.

Learning Activities: Internship 1-5 hour(s).

Repeat Credit: May be repeated 1 time(s) with consent of instructor.

Grade Mode: Pass/No Pass only.

BIS 197T – Tutoring in Biological Sciences (1-5 units)

Course Description: Assisting the instructor by tutoring students in one of the Biological Sciences' regular courses.

Prerequisite(s): Consent of instructor; upper division standing.

Learning Activities: Discussion 2-6 hour(s).

Repeat Credit: May be repeated.

Grade Mode: Pass/No Pass only.

BIS 198 – Directed Group Study (1-5 units)

Course Description: Directed group study. May be taught abroad.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Pass/No Pass only.

BIS 199 – Special Study in Biological Sciences (1-5 units)

Course Description: Special study in Biological Sciences.

Prerequisite(s): Consent of instructor. Upper division standing.

Learning Activities: Independent Study 3-15 hour(s).

Grade Mode: Pass/No Pass only.

BIS 298 – Group Study (1-5 units)

Course Description: College of Biological Sciences staff members offer group study courses under this number.

Prerequisite(s): Consent of instructor.

Learning Activities: Variable.

Grade Mode: Letter.