BIOL R120L: PRINCIPLES OF BIOLOGY I LAB: INTRO TO CELLULAR AND MOLECULAR BIOLOGY

Originator
mnicholson

College
Oxnard College

Discipline (CB01A)
BIOL - Biology

Course Number (CB01B)
R120L

Course Title (CB02)
Principles of Biology I Lab: Intro to Cellular and Molecular Biology

Banner/Short Title
Principles of Biology I Lab

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
This is a laboratory course designed to complement the BIOL R120 lecture course, the first course in the series of biology courses for majors. The current methods employed by investigators in the biological sciences are presented. These include, but are not limited to microscopy, differential centrifugation, chromatography, electrophoresis, spectrophotometry, recombinant DNA methods and PCR.

Taxonomy of Programs (TOP) Code (CB03)
0401.00 - Biology, General

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
May be required

Faculty notes on field trips; include possible destinations or other pertinent information
Possible field trip destinations include local parks, beaches, natural areas, botanical gardens, harbors, islands, natural history museums, and aquaria.

Grading method
Letter Graded

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
52.5
Total Maximum Contact/In-Class Hours
52.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
52.5
Total Maximum Student Learning Hours
52.5

Minimum Units (CB07)
1
Maximum Units (CB06)
1

Prerequisites
BIOL R120 or concurrent enrollment

Entrance Skills

Entrance Skills
Familiarity with cellular composition, components, metabolism, and reproduction.

Prerequisite Course Objectives
BIOL R120-Explain the chemical and molecular aspects of living systems
BIOL R120-Identify subcellular structures and describe their functions
BIOL R120-Explain the components of cellular metabolism
BIOL R120-Describe the process of cell reproduction and relate it to the process of neoplasm

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Requisite Justification

Requisite Type
Prerequisite

Requisite
BIOL R120

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Closely related lecture/laboratory course

Requisite Type
Concurrent

Requisite
BIOL R120

Requisite Description

Course in a sequence

Level of Scrutiny/Justification

Closely related lecture/laboratory course

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Students will demonstrate the ability to formulate and modify hypotheses related to specific observations and/or stated experimental protocols and parameters.
2	Students will be able to identify, manipulate, and quantify variables and controls for experiments.
3	Students will demonstrate the ability to conduct experimentation and present experimental results with text, tables, graphs, maps, media, and/or personal communication.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Perform skills in the observation, collection and evaluation of data including the proper use of a control reaction or sample in each hypothesis driven experiment.
2	Apply standard lab protocols in a safe and conscientious manner while working cooperatively with other students.
3	Demonstrate critical thinking skills as applied to scientific reading and the ability to report data in a scientific format.
4	Exhibit an ability to utilize the light, phase contrast and fluorescence microscope.
5	Operate a centrifuge properly with balanced samples.
6	Compute optical densities with a spectrophotometer using a control and test samples.
7	Measure weights and volumes using electronic scales, micropipetors. pipettes and graduated cylinders.
8	Operate DNA and/or protein electrophoresis equipment to determine molecular weight.
9	Amplify DNA and synthesize proteins in vitro (PCR) or in vivo (transfection/transformation expression).
10	Analyze routine DNA sequencing data from sources including lab experiments, simulations, and published research.

Course Content

Lecture/Course Content

1. The nature of bioscience
   a. Major achievements examples
      i. Germ theory of disease
      ii. Therapeutics derived from biotechnology
2. Scientific method
   a. Paradigm theory
   b. Hypothesis driven normal science
   c. Shifts in paradigms (examples)
      i. Experiments proving bacteria caused ulcers (1989)
      ii. Missing experimental data on why all cancers involve aneuploidy (2009)
3. Measurement and scientific tools
   a. The invention of scientific tools, techniques and protocols specific to certain disciplines
   b. The adoption of existing tools from other fields
4. Use of the microscope
   a. Brightfield
   b. Phase
   c. Fluorescence
5. Cellular structures and functions
   a. Observable structures utilizing various microscopes
   b. Structures that are currently inferred from experimental data
6. PH and buffers
   a. Functioning biological systems and reactions
   b. Creation of buffers from lab reagents

7. Membrane permeability, diffusion and osmosis
    a. Experimental relation to dialysis
8. Properties of macromolecules
    a. Carbohydrates, Proteins, Lipids, Nucleic Acids
9. Enzymes
    a. Demonstration of Proteases, Nucleases, Carbohydrases, and Lipases
    b. Enzyme inhibition
10. Plant anatomy
    a. Movement of fluids for respiration
    b. Reproductive strategies
11. Photosynthesis
    a. Bacterial and Plant
    b. Experiments to quantify NADPH/H+ production from plants
12. Cell respiration
    a. Substrates, intermediates, energetics and oxygen production
    b. Anaerobic respiration
13. Mitosis and meiosis
    a. Stages of cellular division
    b. Crossing over and other unique aspects
    c. Giemsa violet stain
14. Mendelian and non-Mendelian genetics
    a. Corn, fruit flys and other model systems
    b. Antibiotic resistance transfer
    c. Cancer biology and eukaryotic cell culture
    d. Methylation, imprinting and gene silencing/activation
15. Transformation of DNA
    a. Calcium Chloride method
    b. Discussion of electroporation and lipofection
16. Gel electrophoresis
    a. Protein and DNA
    b. Determination of Molecular weight
    c. Relationship to the Western Blot
17. Isolation of genomic DNA
    a. Human Cheek Cell for PCR
    b. Plant DNA using over the counter reagents
18. Polymerase chain reaction
    a. Comparison of types: Traditional vs. Real Time
    b. Oligonucleotide design: Scorpion, Taqman, SYBR
    c. Fluorescence resonance energy transfer (FRET)
19. Western Blot , ELISA, Immunodiffusion
    a. Use of the ELISA plate reader
    b. Relation of the Western to HIV diagnostics
    c. Visualization of antibody interactions in agar
20. Origin of life
    a. Amino acids from carbon, nitrogen, sulfur, hydrogen, electricity and water
    b. Thin Layer Chromatography
21. Eukarya, Bacteria and Archaea
    a. Basic taxonomy
    b. Structures, functions, environments
    c. Winogradsky column and methane/hydrogen production
    d. Spirulina, Yogurt, Kefir, Sauerkraut, Sausage, Camembert, Sourdough, and Wine
    e. Industrial production of ethanol, copper mining, biopharmaceuticals, Mycoplasma
22. Viruses and Bacteriophage
    a. Plaque assay and phage library titering
23. Drosophila, Caenorhabditis, Arabidopsis, Dictyostelium, Saccharomyces and other model systems
    a. Demonstrations and/or experimental procedures as per items A-V

Laboratory or Activity Content

1. The nature of bioscience
    a. Major achievements examples
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Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Skills demonstrations
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Essay exams
Essays
Group projects
Individual projects
Laboratory activities
Laboratory reports
Objective exams
Oral presentations
Problem-Solving Assignments
Quizzes
Reports/papers
Skills demonstrations
Skill tests
Simulations

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Audio-visual presentations
Computer-aided presentations
Collaborative group work
Class activities
Class discussions
Distance Education
Demonstrations
Field trips
Group discussions
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Internet research
Laboratory activities
Small group activities

Describe specific examples of the methods the instructor will use:

1. Live or video presentations of key experiments, such as those demonstrating spectrophotometry, electrophoresis, PCR, and Transformation.
2. Demonstrations of equipment use and experimental processes, such as the use of pipettes, the centrifuge, and an electrophoresis rig.
3. Demonstrations of some key experiments such as antibiotic resistance determination by the Kirby-Bauer Method.
4. Data presentations, often with additional discussion on a white or black board for discussing how each experiment is to be performed generally for all the experiments.
5. Laboratory exercises completed individually or in groups of two or more such as the determination of oxygen produced during photosynthesis.
6. Bioinformatic Exercises such as “Natural Selection and the Rock Pocket Mouse” from HHMI that relate to sections on genetics, protein production, natural selection, and evolution.

Representative Course Assignments

Writing Assignments

1. Formal lab reports for different laboratory exercises must be composed under the guidelines of scientific reporting formats, with citations and bibliographies as required.
2. Written work frequently requires the incorporation of data in the form of graphs, tables, and sketches (e.g., graph of CO_2 produced during fermentation or sketch of cells from a plant leaf).

Critical Thinking Assignments

1. Laboratory work, finished lab reports, and in-class assessments (quizzes and exams) require extensive synthesis of information to allow students to complete the work and then make logical conclusions (e.g., hypothesis testing during lab exercises requires considering an array of explanations, variables, and predicted outcomes).

Reading Assignments

1. Students are assigned pre-lab reading from which they must compose flow-charts for protocols.
2. The instructor will frequently supply additional support materials or students are directed to relevant review articles in current publications such as those from the www.ncbi.nlm.nih.gov Pubmed database (Example: Nature Reviews).
3. Scientific reading from investigative research journals and texts is required to complete some lab reports.

Skills Demonstrations

1. Students will be required to demonstrate proficiency with a variety of laboratory equipment, including the microscope, pipettes, centrifuges, and spectrophotometers that are used during the laboratory experience.

Other assignments (if applicable)

1. Students are encouraged to take advantage of related Internet video or relevant television productions relevant to cellular or molecular biology.
2. A database of instructor-maintained web sites is compiled and utilized for student support and research.
3. Self-guided or group directed field trips are arranged whenever possible; sites visited include the local science museum, natural history museum, botanical and zoological gardens, beaches and biotechnology companies.

Outside Assignments

Representative Outside Assignments

1. Students may be required to complete advanced preparatory reading for in-class labs (e.g., background or intro information for DNA extraction and characterization).
2. Nominal formalization of lab work may be completed outside of lab, including preparation of tables, graphs, and data summaries, as well as written summaries of protocols related to recently-completed laboratory exercises.

Articulation

C-ID Descriptor Number

BIOL 190

Status

Approved

District General Education

A. Natural Sciences

A1. Biological Science
Approved

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

B3 Laboratory Activity
Approved

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

Area F: Ethnic Studies

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 5C: Laboratory Science
Approved

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Manual

Description
Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, Judith Giles Morgan, & M Eloise Brown Carter. (2017). Investigating Biology Laboratory Manual, 9th edition. Pearson. Hoboken, NJ. ISBN 978-0-134-47346-8

Resource Type
Other Resource Type

Description
Additional materials as detailed in lab prep for Urry et al. Investigating Biology Laboratory Manual 9th ed.

Resource Type
Other Resource Type

Description
Video presentations, video clips, and animations.

Resource Type
Other Resource Type

Description
Computer simulations and bioinformatics exercises.

Resource Type
Other Resource Type

Description
Instructor provided handouts such as post-laboratory questions

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.
Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.
Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Discussions focusing on a subject for which students will make an original post and then thoughtfully respond to other student postings; may also allow instructor and students to address miscellaneous questions and related subjects.

Video Conferencing	Video meetings to allow the instructor to highlight important information (perhaps lecture) and facilitate immediate student interaction (such as problem-solving/question/answer session).
Other DE (e.g., recorded lectures)	Recorded tutorials, lectures, and video meetings.
Synchronous Dialog (e.g., online chat)	Instant messaging and/or chat to allow instructor-student and student-student dialogue for teaching and/or studying.
Telephone	Communication venue to allow instructor-student and student-student dialogue for problem-solving/question/answer purposes.
E-mail	Communication venue to allow instructor-student and student-student dialogue for problem-solving/question/answer purposes and to submit certain types of assignments.

Hybrid (51%–99% online) Modality:

Method of Instruction	**Document typical activities or assignments for each method of instruction**
Asynchronous Dialog (e.g., discussion board)	Discussions focusing on a subject for which students will make an original post and then thoughtfully respond to other student postings; may also allow instructor and students to address miscellaneous questions and related subjects.
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E-mail	Communication venue to allow instructor-student and student-student dialogue for problem-solving/question/answer purposes and to submit certain types of assignments.

100% online Modality:

Method of Instruction	**Document typical activities or assignments for each method of instruction**
Asynchronous Dialog (e.g., discussion board)	Discussions focusing on a subject for which students will make an original post and then thoughtfully respond to other student postings; may also allow instructor and students to address miscellaneous questions and related subjects.
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Examinations

Hybrid (1%–50% online) Modality

Online
On campus

Hybrid (51%–99% online) Modality

Online
On campus

Primary Minimum Qualification
BIOLOGICAL SCIENCES

Review and Approval Dates

Department Chair
09/16/2020

Dean
09/16/2020

Technical Review
10/14/2020

Curriculum Committee
10/14/2020

DTRW-I
MM/DD/YYYY

Curriculum Committee
12/09/2020

Board
MM/DD/YYYY

CCCCO
MM/DD/YYYY

Control Number
CCC000094502

DOE/accreditation approval date
MM/DD/YYYY