MICR R100L: PRINCIPLES OF MICROBIOLOGY LABORATORY

Originator
jharber

College
Oxnard College

Discipline (CB01A)
MICR - Microbiology

Course Number (CB01B)
R100L

Course Title (CB02)
Principles of Microbiology Laboratory

Banner/Short Title
Principles of Microbiology Lab

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
This course is an introduction to the structure, metabolic activities, utility and pathogenicity of bacteria, fungi, algae, protozoa and viruses. The topics will include distribution, metabolism, molecular genetics, biotechnology, immunity, cancer, probiotics and the physical/chemical methods used in control of microbes and cellular pathogens. The principles of disease transmission, prevention and immunity will also be presented. The diversity of the microbial world and its applications to improving human health and quality of life are emphasized.

Taxonomy of Programs (TOP) Code (CB03)
0403.00 - Microbiology

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
Will not be required

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
105
Maximum Contact/In-Class Laboratory Hours
105

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
105
Total Maximum Contact/In-Class Hours
105

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
105
Total Maximum Student Learning Hours
105

Minimum Units (CB07)
2
Maximum Units (CB06)
2

Prerequisites
MICR R100 or concurrent enrollment

Entrance Skills

Entrance Skills

Understand microbial structure and function of prokaryotes/eukaryotes, microbial taxonomy, metabolism, disease transmission and prevention.

Prerequisite Course Objectives

MICR R100-Describe the structure and function of prokaryotic and eukaryotic cells.
MICR R100-Compare and contrast eukaryotic cell structure with that of the prokaryote.
MICR R100-Analyze the fluid nature of bacterial taxonomy.
MICR R100-Categorize the basic principles of microbial control.
MICR R100-Summarize the diversity of forms in the microbial world.
MICR R100-Distinguish the diversity of microbial metabolism.
MICR R100-Illustrate the principles of disease transmission and prevention.

Entrance Skills

Understand the human innate and adaptive immune system and host defense mechanisms that form the basis for immunological diagnostic assays.

Prerequisite Course Objectives

MICR R100-Distinguish the diversity of microbial metabolism.
MICR R100-Interpret the immune system's functions and various host defense mechanisms found in the eukaryotes.

Entrance Skills

Demonstrate understanding of biosafety levels for working safely with microorganisms

Prerequisite Course Objectives

MICR R100-Categorize the basic principles of microbial control.
MICR R100-Illustrate the principles of disease transmission and prevention.

Entrance Skills

Knowledge of biochemistry, biotechnology, microbial genetics and microbial evolution and how they apply to diagnostic technologies used to identify and characterize pathogens.

Prerequisite Course Objectives

MICR R100-Distinguish the diversity of microbial metabolism.

MICR R100-Demonstrate an understanding of microbial genetics as they relate to microbial evolution, recombinant DNA technologies and biotechnology.

Requisite Justification

Requisite Type

Prerequisite

Requisite

MICR R100

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	The student will have the ability to proceed stepwise biochemical laboratory tests in solving the identity of an unknown bacterium.
2	The student will be capable of producing a laboratory notebook, indexed and paginated with the current semester's schedule.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Demonstrate the principles of asepsis
2	Operate a light microscope
3	Perform standard bacteriological staining procedures
4	Cultivate, transfer and maintain pure microbial cultures
5	Explain an understanding of the principles of fermentation and applied microbiology
6	Perform modern recombinant DNA technology methods
7	Analyze the role of microbes in the biosphere
8	Identify the role of normal body flora
9	State an understanding of colonization and infectious disease
10	Determine the identity of a simple unknown bacterium
11	Discuss the role of microbiology in medicine, food production, biotechnology and agriculture

Course Content

Lecture/Course Content

1. Microscopy and microbial diversity
   a. Care and use of the bright-field light microscope
   b. Care and use of the fluorescence microscope
   c. Care and use of the phase contrast microscope
   d. Observation of bacteria, microscopic eukaryotes, and blood cells (slides).
   e. Observation of microscopic organisms from environmental sources
2. Basic Staining Techniques
   a. Gram
   b. Acid Fast
   c. PHB
   d. Endospore

   e. Flagellar
   f. Fluorescent
3. Microbial Growth
   a. Growth
   b. Measurement of Growth
   c. Phases of Growth in Closed Systems
   d. Maintenance of pure culture
4. Nutrition and Cultivation
   a. Nutritional Requirements
   b. Culture Conditions
   c. Media
   d. Culture Characteristics
5. Methods of Identification
   a. Entertube II or API method
   b. PCR-Sequencing
   c. Standard keys utilizing biochemical tests
6. Antibiotic Sensitivity Testing Methods
   a. Kirby-Bauer
   b. E-Test
7. Quality Control Methods
   a. Plate Counts
   b. Coliform Testing
8. Investigation of Geochemical Microbiology
   a. Biogas and Alcohol production
   b. Winogradsky column
9. Biotechnologies
   a. Transformation
   b. RT-PCR
   c. DNA Extraction
   d. DNA Sequencing (outsourced)
   e. Phage plaque assay and purification
10. Immunological Assays
   a. Agglutination
   b. Elisa
   c. Western Blot
   d. Immunoprecipitation
11. Eukaryotic Cell Culture
   a. Cell Culture Methods
12. Applied Microbiology
   a. Plant Virus: TMV
   b. Animal Virus: Bacculovirus
   c. Microbes used in food production
13. Medical and Dental Microbiology
   a. Specialized media for skin, throat, and urogenital cultures
   b. Specialized media for oral cultures
   c. Sampling methods for determination of cancer (oral, GI, skin)
14. Aseptic technique
   a. Determination of disinfectant and sanitizer effectiveness
   b. Operation of the laminar flow biosafety cabinet
   c. Appropriate use of gloves, gowns and goggles

Laboratory or Activity Content

1. Microscopy and microbial diversity
   a. Care and use of the bright-field light microscope
   b. Care and use of the fluorescence microscope
   c. Care and use of the phase contrast microscope
   d. Observation of bacteria, microscopic eukaryotes, and blood cells (slides).
   e. Observation of microscopic organisms from environmental sources
2. Basic Staining Techniques

   a. Gram
   b. Acid Fast
   c. PHB
   d. Endospore
   e. Flagellar
   f. Fluorescent
3. Microbial Growth
   a. Growth
   b. Measurement of Growth
   c. Phases of Growth in Closed Systems
   d. Maintenance of pure culture
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   a. Nutritional Requirements
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   c. Sampling methods for determination of cancer (oral, GI, skin)
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   b. Operation of the laminar flow biosafety cabinet
   c. Appropriate use of gloves, gowns and goggles

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):

Clinical demonstration
Computational homework
Essay exams
Essays
Film/video productions
Graphic/architectural designs
Group projects

Individual projects
Journals
Laboratory activities
Laboratory reports
Objective exams
Oral presentations
Problem-Solving Assignments
Problem-solving exams
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
Clinical demonstrations
Class activities
Class discussions
Case studies
Distance Education
Demonstrations
Group discussions
Instructor-guided use of technology
Internet research
Laboratory activities
Lecture
Other (specify)
Role-playing
Small group activities

Specify other method of instruction

Discussions involving student to student interactions (including Canvas discussions online).

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 Gram stain (individually) or the Elisa assay (group activity).
6. Bioinformatic Exercises. The lab uses data generated from experiments and databases to solve inquiries as to the identity of bacteria. Bioinformatics resources online will be used from the United States (NCBI, BLAST and FDA/CLIA), England (UK Standards for Microbiological Investigations) and Germany (BacDive database of phenotypic/biochemical characteristics).

Representative Course Assignments

Writing Assignments

Writing a Laboratory Notebook in corrected English (using the Microsoft Word standard of sentence and grammar check without bullet points) from observation and participation in live experiments is expected. A Powerpoint report (using the MS Word standard and basic elements of english composition) is expected to be prepared on an FDA approved diagnostic test from the CLIA database.

Critical Thinking 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.

Reading Assignments

1. Beyond the required laboratory texts, students will be required to consult peer-reviewed journals on the Internet for source information on microbiological methods. The site www.ncbi.nlm.nih.gov contains the Pubmed database where review articles can be located. Other sources of information for locating diagnostic tests for rapidly determining disease identity include Google patents, the www.cdc.gov, the www.who.gov and FDA literature on approved diagnostic tests. It is particularly important that the student understand that many classical methods of microbiology are being augmented by newer tests based on biotechnology principles.

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. The preparation of a powerpoint presentation related to a diagnostic method or other aspect of microbiology is an expectation of the course.

Outside Assignments

Articulation

Equivalent Courses at 4 year institutions

University	Course ID	Course Title	Units
CSUCI	BIOL 301	Microbiology	4

Comparable Courses within the VCCCD

MICR M01 - General Microbiology

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
Los Angeles City College	Microbiology 1	Introductory Microbiology	5

Attach Syllabus

Syllabus Microbiology Lab Fall 2020.docx

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

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
Textbook

Classic Textbook
Yes

Description
Leboff, M. J., and Pierce, B. E. *Microbiology Laboratory Theory & Application, Full Edition* (fourth edition, 2015); Englewood, CO; Morton Publishing.

Resource Type
Software

Description
Earth Microbiome. Argonne National Laboratory.

Resource Type
Manual

Description
John G. Holt PhD (1994-01-01). *Bergey's Manual of Systematic Bacteriology*. Lippincott Williams Wilkins (This is the most current version).

Resource Type
Other Resource Type

Description
Pubmed review and primary literature from the site: www.ncbi.nlm.nih.gov.

Resource Type
Other Resource Type

Description
Blast Program (www.ncbi.nlm.nih.govBlast is a program used to identify matching DNA sequences in a database of microorganisms. The students produce a DNA from an unknown bacteria using the PCR method. The PCR "fragment" is sent by mail for DNA sequencing and the identity of the sequence is returned by email. The sequence can then be used to probe the Blast database for a match to known microorganisms (thus providing identity)..

Resource Type
Other Instructional Materials

Description
A myriad of slides, culture plates and extracts of live cultures.

Resource Type
Other Instructional Materials

Description
Computer projection, Internet Based Animations and Video.

Resource Type
Other Instructional Materials

Description
Microscope, PCR machine, Gel Electrophoresis and other standard lab equipment.

Resource Type
Software

Description
FDA CLIA database of diagnostic tests for microbiology
https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfCLIA/search.cfm

Resource Type
Software

Description
Bacdive database of phenotypic characters for determining the identity of microbes
https://bacdive.dsmz.de/

Resource Type
Manual

Description
UK Standards for Microbial Investigations of Bacterial Identity (BSOP ID1). This set of documents is not available as a comparable from other sources.
https://www.gov.uk/government/collections/standards-for-microbiology-investigations-smi

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

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Video Conferencing	Zoom/video meetings to allow the instructor to highlight important information (perhaps lecture) and facilitate immediate student interaction (such as problem-solving/question/answer session).

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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Other DE (e.g., recorded lectures)	Recorded tutorials, lectures, and Zoom/video meetings.
Telephone	Communication venue to allow instructor-student and student-student dialogue for problem-solving/question/answer purposes.

100% online Modality:

Method of Instruction	**Document typical activities or assignments for each method of instruction**
Video Conferencing	Zoom/video meetings to allow the instructor to highlight important information (perhaps lecture) and facilitate immediate student interaction (such as problem-solving/question/answer session).
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
09/15/2020

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
CCC000308524

DOE/accreditation approval date
MM/DD/YYYY