

PERALTA COMMUNITY COLLEGE DISTRICT COURSE OUTLINE

COLLEGE:	Laney College	STATE APPROVAL DATE:	06/14/2011
ORIGINATOR:	Leslie Blackie	STATE CONTROL NUMBER:	CCC000525835
		BOARD OF TRUSTEES APPROVAL DATE:	06/14/2016
		CURRICULUM COMMITTEE APPROVAL DATE:	04/15/2016
		CURRENT EFFECTIVE DATE:	08/22/2016

DIVISION/DEPARTMENT: Laney College

1. REQUESTED CREDIT CLASSIFICATION:

Credit - Degree Applicable
 Course is not a basic skills course.
 Program Applicable

2. DEPT/COURSE NO:

BIOL 073

3. COURSE TITLE:

Cell Culture Principles and Techniques

4. COURSE: Laney Course
 Updating

TOP NO. 0430.00

5. UNITS: 4.00

HRS/WK LEC: 2.00 Total: 35.00

HRS/WK LAB: 6.00 Total: 105.00

HRS/WK TBA:

6. NO. OF TIMES OFFERED AS SELETED TOPIC: AVERAGE ENROLLMENT:

7. JUSTIFICATION FOR COURSE:

The ability to manipulate cell cultures and understand the principles governing ex vivo growth of diverse cell types is essential for the manufacture of biological products. This Course is required for the A.S. Degree in Biomanufacturing.

8. COURSE/CATALOG DESCRIPTION

Cell culture techniques and principles: Aseptic conditions, sterile techniques, media preparation, quantification and passage of cell lines, cell cycle, growth factors, understanding, avoiding, and detecting contamination, cell structure and differentiation working with different types of cells including bacterial, yeast, plant and mammalian cells. Laboratory includes preparation for work in the manufacture of biological products.

9. OTHER CATALOG INFORMATION

a. Modular: No If yes, how many modules:

b. Open entry/open exit: No

c. Grading Policy: Letter Grade Only

d. Eligible for credit by Exam: No

e. Repeatable according to state guidelines: No

f. Required for degree/certificate (specify):

Biomanufacturing Production, Biomanufacturing Production

g. Meets GE/Transfer requirements (specify):

CSU

h. C-ID Number: BIOT 230 BX Expiration Date:

i. Are there prerequisites/corequisites/recommended preparation for this course? Yes

Date of last prereq/coreq validation: 04/15/2016

- 10. LIST STUDENT PERFORMANCE OBJECTIVES (EXIT SKILLS):** (Objectives must define the exit skills required of students and include criteria identified in Items 12, 14, and 15 - critical thinking, essay writing, problem solving, written/verbal communications, computational skills, working with others, workplace needs, SCANS competencies, all aspects of the industry, etc.)(See SCANS/All Aspects of Industry Worksheet.)

Students will be able to:

1. Explain the purpose of and prepare media using various components
2. Describe the basic theory of cell culture
3. Document laboratory procedures, observations, and conclusions in a laboratory notebook.
4. Demonstrate aseptic technique methodology required for the culture of diverse cell types in a laminar flow hood.
5. Assess the presence of different types of contamination in cell cultures and determine the resultant effects for cell cultures.
6. Demonstrate proper passaging, thawing, and cryopreservation of cells.
7. Assess the benefits and disadvantages of different cell types in the manufacture of specific biologic products.
8. Solve mathematical calculations involved in making solutions, cell enumeration, cell passaging, cell culture inoculation and analyze data related to cell growth and survival.
9. Monitor the health of cell cultures using multiple parameters and assays.
10. Demonstrate proficiency in the use of cell culture facility equipment, including biosafety cabinets, incubators, spectrophotometers, hemocytometers, autoclaves, vacuum pump aspirators, and microscopes.

- 11A. COURSE CONTENT:** List major topics to be covered. This section must be more than listing chapter headings from a textbook. Outline the course content, including essential topics, major subdivisions, and supporting details. It should include enough information so that a faculty member from any institution will have a clear understanding of the material taught in the course and the approximate length of time devoted to each. There should be congruence among the catalog description, lecture and/or lab content, student performance objectives, and the student learning outcomes. List percent of time spent on each topic; ensure percentages total 100%.

LECTURE CONTENT:

1. Cell structure (5%)

- a. Prokaryotic versus eukaryotic cell structure
- b. Eukaryotic organelle structure and function

2. Basic theories of cell culture (10%)

- a. Binary fission and mitosis
- b. Cell cycle regulation
- c. Growth factors
- d. Contact inhibition and density dependence
- e. Cell death and senescence in culture

3. Equipment and vessels used in Cell Culture (5%)

- a. microscopes (compound, inverted, phase contrast)
- b. CO2 incubator

c. Biosafety cabinet

d. water baths

4. Cell strains and cell lines (10%)

a. Establishing a cell line, sources and types of cells

b. Primary cell cultures

c. Continuous cell lines

d. Plant callus cultures and protoplast cultures

e. Characteristics of cell strains and cell lines commonly used in biomanufacturing

f. cell counting and assessment of cell culture health

g. calculations relating to cell concentrations, plating efficiency and growth curves

h. cryopreservation and resuscitation

5. Stem cell biology and differentiation (10%)

a. Embryonic, adult, and induced pluripotent stem cells

b. Generation of stem cell line

c. Therapeutic applications

d. Regulatory policy

6. Culture media (10%)

a. Components and parameters (e.g. pH, dO₂, osmolarity)

b. Nutritional needs of different cell types

c. Methods of sterilization

d. Contamination (chemical and biological)

7. Clean room parameters, working in Biosafety cabinet (10%)

a. Good Manufacturing Practices and Biosafety levels

b. Facility Design

c. Validation

d. preventing contamination

8. Expression of heterologous proteins and macromolecules in cultured cells (15%)

a. Transcriptional and translational control

b. Vectors (plasmid, viral)

c. Transient and stable expression

d. Introduction of DNA into cells (transformation, transfection, infection)

e. Selection methods (microscopic, biochemical, cell sorting)

f. Post-Translational modification

g. induction of differentiation

9. Biomanufacturing products produced in cultured cells (10%)

a. Recombinant therapeutic proteins

b. Monoclonal antibodies

c. Vaccines

d. Gene therapy

e. siRNA

f. Genetically modified crops

10. Analysis in cell culture (10%)

a. Verification of cell identity

b. Assay design

c. Survival and cell toxicity analysis

d. Stains for analysis

11. Documentation, observation and analysis of experimental results (5%)

11B. LAB CONTENT:

1. Review of metrics, scientific notation, and calculations for preparing solutions (5%)

2. Following SOPs, record keeping in lab notebook(5%)

a. maintain lab notebook

b. procedures handling raw materials and record keeping of materials

3. Accurate measurement of small volumes and masses (5%)

a. Pipetting

b. Micropipetting

c. Analytical Balance

4. Aseptic techniques required for culturing different cell types (10%)

a. sterile transfer techniques for bacterial and yeast bench work

b. sterile technique in biosafety cabinet

5. Proper Use of equipment and instrumentaton for cell culture (10%)

a. Biosafety cabinet

b. incubators

c. water baths

d. Microscope

- e. centrifuge
- f. hemacytometer
- g. Spectrophotometer
- f. Vacuum pump aspirator
- g. Monitoring equipment (pH meter, osmometer, DO₂ probe)

6. Media preparation, sterilization of media and additives, and monitoring (10%)

- a. Making solutions
- b. Use of autoclave
- c. Filter sterilization methods
- d. Pouring agar plates
- e. Confirmation of sterility, pH and other parameters.

7. Cell enumeration methodology for different cell types (5%)

- a. Spectrophotometric determination (optical density) of bacterial cell concentrations
- b. Use of hemacytometer and cell counter
- c. Cell viability assay; trypan blue exclusions

8. Inoculation of solid and liquid bacterial and yeast cultures (5%)

9. Passaging and maintenance of mammalian cells (10%)

- a. Subculture and feeding of suspension cells
- b. Subculture, trypsinization and feeding of adherent cells

10. Monitoring health of cell cultures (10%)

- a. Environmental monitoring (pH, dO₂, osmolality)
- b. Microscopic observation
- c. Growth curves

11. Evaluation of contamination (5%)

- a. Microscopic evaluation
- b. Detection of Mycoplasma
- c. Detection of endotoxin

12. Cryopreservation and storage of cell lines (5%)

- a. Preparation of sterile cryopreservation medium
- b. Cell Freezing
- c. Cell Resuscitation of frozen cells
- d. Evaluation of freeze/thaw techniques (colony forming assay, trypan blue exclusions viability assay)
- e. Cell banking logs and practices

13. Expression of heterologous proteins in cultures cells (10%)

- a. transformation
- b. transfection

14. Cell harvesting and lysis (5%)**12. METHODS OF INSTRUCTION** (List methods used to present course content.)

- 1. Experiments
- 2. Field Trips
- 3. Lab
- 4. Lecture
- 5. Observation and Demonstration
- 6. Activity
- 7. Discussion

13. ASSIGNMENTS: 8.00 hours/week (List all assignments, including library assignments. Requires two (2) hours of independent work outside of class for each unit/weekly lecture hour. Outside assignments are not required for lab-only courses, although they can be given.)

Out-of-class Assignments:

- 1. Reading assignments from textbook and supplemental reading
- 2. Preparation of laboratory notebook
- 3. Preparation of written paper
- 4. Preparation of oral presentation

ASSIGNMENTS ARE: (See definition of college level):
Primarily College Level

14. STUDENT ASSESSMENT: (Grades are based on):

ESSAY (Includes "blue book" exams and any written assignment of sufficient length and complexity to require students to select and organize ideas, to explain and support the ideas, and to demonstrate critical thinking skills.)

COMPUTATION SKILLS

NON-COMPUTATIONAL PROBLEM SOLVING (Critical thinking should be demonstrated by solving unfamiliar problems via various strategies.)

SKILL DEMONSTRATION

MULTIPLE CHOICE

ESSAY (Includes "blue book" exams and any written assignment of sufficient length and complexity to require students to select and organize ideas, to explain and support the ideas, and to demonstrate critical thinking skills.)

OTHER (Describe):

Exams including written and lab practical examinations components
Assess lab notebooks
Written reports on experiments
Oral presentations of experiments

15. TEXTS, READINGS, AND MATERIALS

A. Textbooks:

Bruce Alberts . 2013. *Essential Cell Biology* 4th. Garland Science

Davey, M.R. and Anthony, P. 2010. *Plant Cell Culture: Essential Methods* 1st. Wiley-Blackwell
Rationale: Instructors in the biomanufacturing program continue to look for updated editions on plant cell culture, but have agreed to continue to use this edition of plant cell culture.

Ian Freshney. 2016. *Culture of Animal Cells: A manual of Basic Techniques* 7th edition. wiley-blackwell

Supplemental Readings

*Date is required: Transfer institutions require current publication date(s) within 5 years of outline addition/update.

B. Additional Resources:

Library/LRC Materials and Services:

The instructor, in consultation with a librarian, has reviewed the materials and services of the College Library/LRC in the subject areas related to the proposed new course

Are print materials adequate? Yes

Are nonprint materials adequate? Yes

Are electronic/online resources available? Yes

Are services adequate? Yes

Specific materials and/or services needed have been identified and discussed. Librarian comments: Originator has provided a list of recommended titles.

C. Readings listed in A and B above are: (See definition of college level):

Primarily college level

16. DESIGNATE OCCUPATIONAL CODE:

C - Occupational

17. LEVEL BELOW TRANSFER:

Y = Not Applicable

SUPPLEMENTAL PAGE

Use only if additional space is needed. (Type the item number which is to be continued, followed by "continued." Show the page number in the blank at the bottom of the page. If the item being continued is on page 2 of the outline, the first supplemental page will be "2a." If additional supplemental pages are required for page 2, they are to be numbered as 2b, 2c, etc.)

1a. Prerequisites/Corequisites/Recommended Preparation:

PREREQUISITE(S):

BIOL 075: Fundamentals of Biotechnology

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