C-ID Descriptor
Applied Biotechnology with Laboratory

Descriptor Details

- **Descriptor Title**: Applied Biotechnology with Laboratory
- **C-ID Number**: 150
- **Suffix**:
  - Community College Use Only (X)
- **Units**: 4
- **Hours**: 0000
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General Description

This course prepares students for entry-level work in the biotechnology industry by emphasizing the core concepts needed to work effectively in a bioscience laboratory. Topics include laboratory math, basic chemistry of buffers, health and safety, metrology, quality control, biological molecules, gene expression, cell structure and molecular biology techniques. This course introduces students to standard biotechnology laboratory skills including laboratory measurements, preparation of solutions, data collection and evaluation, basic separation methods, molecular techniques, aseptic technique and documentation. Good communication and work-readiness skills are emphasized.

Prerequisites

No information provided

Corequisites

None

Advisories

Algebra (C-ID MATH 150 or C-ID MATH 151), English (C-ID ENGL 100), Biology course that includes a lab, Introductory Chemistry (CHEM 101)

Content

Lecture Topics:

Scientific method

Laboratory math

- Units of Measurement and Converting between Units (Metric System)
- Graphical Methods of Analysis and Data Display
- Various Methods of Expressing Concentration
- Calculation for Molar and Percent Solution
- Dilutions
- Reagents, Solutions and Media Formulations

Basic chemistry of buffers and pH

Biotechnology overview

Work-readiness skills

- Oral communication
- Written communication
- Teamwork

Health and Safety

- MSDS/SDS
- Personal Protection Equipment
- Contamination

Metrology: Common Laboratory Measurements

- Weight
- Volume

- pH
- Temperature
- Spectrophotometry

Quality Control

- Biological molecules
- Cell Structure
- Gene expression
- DNA technology and analysis
- Cell culture and fermentation
- Bioseparation (protein purification, agarose gel, etc.)

Lab Activities

- Basic separation methods and analysis (at least 4 of the following)
  - DNA electrophoresis
  - Protein electrophoresis
  - Column chromatography
  - Protein assay (quantity)
  - Protein assay (function)
  - Centrifugation
  - Filtration
- Other Protocols (at least 4 of the following molecular techniques)
  - Plasmid isolation
  - PCR
  - Restriction digestion
  - Bioinformatics
  - Nucleic Acid Technology
  - Western Blot
  - ELISA
- Inoculation/growth of cell cultures
- Lab safety
- Metrology (pH, balance, volumes, micropipetting, spectrophotometry)
- Biological Solutions, including media preparation, autoclaving, pH determination and adjustment
- Aseptic technique

- Data collection and evaluation
- Documentation and record keeping in lab notebook

Objectives

At the conclusion of this course, the student should be able to:

- Describe cell structure
- Apply principals of basic chemistry of buffers and pH to biological molecules
- Define and distinguish among biological molecules
- Construct the flow diagram of gene expression from DNA to protein
- Explain recombinant DNA
- Be able to convert between metric units
- Be able to perform basic dilutions
- Perform calculations related to reagents, solutions and media formulations
- Demonstrate Good Laboratory Practices and record keeping in a laboratory notebook
- Prepare and analyze graphs
- Grow cells using aseptic techniques
- Demonstrate ability to use measurement instrumentation properly
- Perform a concentration assay for DNA or Protein
- Successfully perform a basic bio-separation technique such as column chromatography
- Perform a molecular technique such as DNA sizing electrophoresis

Evaluation Methods

A variety of assessment techniques that may include midterm exam, term paper, projects, homework problems, lab reports, lab practical, and lab projects. There should be a scientific communication component (eg. written reports, presentations, discussions). Documentation including lab notebook record-keeping in a regulated environment should be included in the evaluation section.

Textbooks

Introduction to Biotechnology (3rd Edition) by William J. Thieman and Michael A. Palladino (Jan 23, 2012) ISBN 978-0321766113

Basic Laboratory Calculations for Biotechnology by Lisa A. Seidman (Apr 28, 2007) ISBN 978-0132238106

Basic Laboratory Methods for Biotechnology (2nd Edition) by Lisa A. Seidman and Cynthia J. Moore (Nov 8, 2008) ISBN 978-0321570147

Laboratory Manual for Biotechnology and Laboratory Science: The Basics by Lisa A. Seidman, Mary Ellen Kraus, Diana Brandner and Jeanette Mowery (Nov 6, 2010) ISBN 978-0321644022

Campbell Essential Biology (5th Edition) by Eric J. Simon, Jean L. Dickey and Jane B. Reece (Feb 19, 2012) ISBN 978-0321772596

Biology by Sylvia Mader and Michael Windelspecht (Jan 3, 2012) ISBN 978-0073525501

Basic Methods for the Biochemical Lab (Springer Lab Manuals) by Martin Holtzhauer (Jul 19, 2006)

ISBN 978-3540327851

Biotechnology: Academic Cell Update Edition by David P. Clark BA (honors) Christ's College Cambridge 1973, PhD University of Brsitol (England) 1977 and Nanette J. Pazdernik (Jan 12, 2011) ISBN 978-0123850638

Biotechnology: Science for the New Millennium by Ellyn Daugherty (2007) ISBN 978-0008453138

Principles of Biology by Nature Education (2011: online, “living” text) Nature Publishing group

Molecular Biotechnology: Principles and Applications of Recombinant DNA by Bernard R. Glick and Jack J. Pasternak (Nov 1, 2009) 978-1555814984

Fundamental Laboratory Approaches for Biochemistry and Biotechnology by Alexander J. Ninfa and David P. Ballou (May 26, 2009) 978-0470087664

Biotechnology: A Laboratory Skills Course by Bio-Rad 978-0-9832396-0-4

Biomanufacturing Laboratory Manual. Northeast Biomanufacturing Center and Collaborative. 2012.