AIChE eLearning Course Outline

Biotechnology for Chemical Engineers

Course Outline

Lecture 1- Survey of Microorganisms and Cells

Objectives

At the conclusion of this lecture, students should be able to:

- Define microorganisms and cell lines and explain their importance in the manufacture of proteins and peptides
- Define commonly used terms in the biotechnology and biomanufacturing industries
- Identify the different criteria used to select suitable protein expression systems
- Explain why specific products are manufactured by different types of expression systems
- Describe the types of microorganisms and cell lines used in industry

Lecture 2 - Microbial and Cell Identification by Morphology, Physiology and Genome Sequencing

Objectives

At the conclusion of this lecture, students should be able to:

- Recognize the different characteristics necessary to identify microorganisms and cell lines
- Describe the types of morphologic features used to identify bacteria
- Identify the metabolic pathways involved in identification of diverse microbes
- List the principles of current methods of microbial identification by genotype, phenotype and phylogeny
- Identify the diverse laboratory techniques used for identification of microorganisms and cell lines

Lecture 3 - Overview of Biological Drug Products

Objectives

At the conclusion of this lecture, students should be able to:

- Define biological drugs
- Identify categories of biological drugs, including those derived from GMO and non-GMO sources
- Recall expression systems used for recombinant biological drugs
- Recognize current methods for production of major biological drugs

Lecture 4- Basic Genetic Engineering of Microorganisms for Cell Line Development

Objectives

At the conclusion of this lecture, students should be able to:

- Define *molecular cloning* and *genetic engineering* and explain their importance in the biotechnology industry
- Define the basic steps involved in generating a genetically engineered microorganism
- Identify the various molecular biology techniques used to clone, characterize and express a gene of interest
- Describe the components of a gene cloning system
- Identify the genetic components involved in the selection of suitable cell lines for production of biologics

Lecture 5- Metabolic Engineering and Use of "Omics"

Objectives

At the conclusion of this lecture, students should be able to:

- Define metabolic engineering and inverse metabolic engineering and explain their importance in the biotechnology industry
- Classify bioproducts
- Identify examples of metabolic engineered strains currently in use in the biomanufacturing industry
- Define the components of "omics" technologies
- Describe the 2-D gel electrophoresis and DNA microarray technologies and their uses in developing and characterizing new metabolic engineered strains

Lecture 6- Expression and Purification of Biological Drug Products

Objectives

At the conclusion of this lecture, students should be able to:

- Explain how recombinant organisms are generated
- Identify different organisms used for expression of biological products
- Recognize the specificity of each expression system
- Identify the advantages and disadvantages of each system
- Recall the different steps in the purification process

Lecture 7 - Monitoring Cell Growth and Product Expression

Objectives

At the conclusion of this lecture, you should be able to:

- Describe a typical cell growth kinetics with its corresponding product formation
- Determine the factors capable of affecting optimal cell growth and product formation as well as their measurements
- Identify the technologies used to monitor the total number of cells, number of viable cells, and cell biomass
- Identify the techniques used to monitor the expression of the desired product by its presence and identity as well as its specific activity
- Identify examples of these technologies currently in use in the biotechnology industry

Lecture 8- Basic Concepts of Fermentation and Cell Culture

Objectives

At the conclusion of this lecture, students should be able to:

- Compare and contrast processes for fermentation and cell culture
- Describe the basic characteristics of cell growth
- List different modes of production
- List different feeding strategies
- Explain the kinetics of various feeding strategies