

One Semester Three-Unit Concepts-based Survey Course Plan

Suggested Lesson Planning Guide

16 weeks, three 1-hour non-lab class lecture-discussion meetings/weeks

A total of 48 class meetings

The corresponding section of the text should be assigned as reading either before or after the class meeting, as determined by the instructor

Chapter Section	Lesson Objective	Key Concepts in Lecture/Discussion/Lesson
1.1 1.2	Defining Biotechnology Biotechnology Products	<ul style="list-style-type: none">- Biotechnology definition/description/domains- Examples of products and companies- Genetically engineered products
1.3	Selecting Potential Products	<ul style="list-style-type: none">- Product Development Plan- Research and Development, manufacturing- Testing/clinical trials, regulation
1.5	Biotech Careers	<ul style="list-style-type: none">- Types of Jobs/Careers- Educational Requirements
1.6	Bioethics	<ul style="list-style-type: none">- Morals and ethics- Values Clarification Model for Decision-making
2.1 2.2	Organisms and their Parts Cellular Organization	<ul style="list-style-type: none">- Levels of biological organization- Prokaryotic versus eukaryotic cells- Model organisms and product manufacture- Cell structure and role in biotech,
2.3	Molecules of Cells (2 class meetings)	<ul style="list-style-type: none">- Survey of carbohydrates, lipids, proteins, and nucleic acids
2.4	The New Biotechnology	<ul style="list-style-type: none">- Central Dogma of Biology- Recombinant DNA- Synthesis of genetically engineered products
4.1	DNA Structure and Function	<ul style="list-style-type: none">- Double helix of nucleotide chains- Nitrogenous bases and base pairing- Semi-conservative replication- Protein synthesis
4.2 4.3	Sources of DNA Isolating DNA	<ul style="list-style-type: none">- Prokaryotic, eukaryotic, viral DNA- Gene expression- Media prep, bacterial cell culture, sterile technique- Vectors and rDNA technology- Transformation
4.4	Studying DNA using Gel Electrophoresis	<ul style="list-style-type: none">- How a gel box separates molecules- Agarose gel electrophoresis- Data from agarose gels
5.1	Protein Structure Protein Function	<ul style="list-style-type: none">- Protein functions- Importance of antibodies and enzymes

5.2	Protein Production	<ul style="list-style-type: none"> - Protein synthesis - Transcription, Translation
5.3	Enzymes	<ul style="list-style-type: none"> - Enzyme activity
5.4	Studying Proteins	<ul style="list-style-type: none"> - Polyacrylamide gel electrophoresis
5.5	Applications of Protein Analysis	<ul style="list-style-type: none"> - Protein Indicators - Data from PAGE gels
6.1	Sources of Products	<ul style="list-style-type: none"> - Products from nature
6.2	Product Assays	<ul style="list-style-type: none"> - Comprehensive Product Development Plan - Assays and their applications
6.3	Searching for New Products	<ul style="list-style-type: none"> - Herbal remedies, Rainforest products - Active ingredients - Antibiotics and antiseptics
6.4	Plant Products	<ul style="list-style-type: none"> - Plant protein products
6.5	Producing rDNA Products	<ul style="list-style-type: none"> - Recombinant DNA Products
8.1	Steps in Genetic Engineering (2 class meetings)	<ul style="list-style-type: none"> - Locating “genes of interest” - Restriction enzymes and recombinant DNA - Cloning and manufacturing
8.2	Transforming Cells (2 class meetings)	<ul style="list-style-type: none"> - Transformation, transduction, and transfection - Making rDNA, endonucleases, and RFLPs - Performing a transformation, selection of transformants
8.3	After Transformation	<ul style="list-style-type: none"> - Scale-up of transformants - Products Assays
8.4	Fermentation, Manufacturing, and GMP	<ul style="list-style-type: none"> - Kinds of fermentation - Growing cultures, bacterial and mammalian cell culture - cGMP
9.1	Harvesting Protein Product	<ul style="list-style-type: none"> - Protein recovery from cell culture - Introduction to column chromatography
9.4	Product Quality Control (2 class meetings)	<ul style="list-style-type: none"> - Quality Control, Quality Assurance, QC/QA testing - Clinical Testing
9.5	Marketing and Sales	<ul style="list-style-type: none"> - Factors that affect sales - Proprietary/Patent Rights
10.1	Plant Propagation	<ul style="list-style-type: none"> - Sexual versus asexual reproduction (cloning) - Meiosis and sex cell formation - Pollination and fertilization
10.2	Plant Anatomy	<ul style="list-style-type: none"> - Plant cells, tissues, and organs
10.3	Plant Growth and Structure	<ul style="list-style-type: none"> - Meristematic tissue - Isolating Plant DNA - Mitosis and growth - Seed germination
10.4	Plant Breeding	<ul style="list-style-type: none"> - Alternation of generations - Genotypes and phenotypes - Selective breeding and Punnett squares
10.5	Statistical Analysis	<ul style="list-style-type: none"> - Averages, 10% rule, standard deviation, and Chi square analysis

11.1 11.2	Cloning Plants Tissue Culture	<ul style="list-style-type: none"> - Asexual plant propagation, plant tissue culture - Plant hormones - Starting and maintaining cultures
11.3	Biotech in Agriculture and Horticulture	<ul style="list-style-type: none"> - Selective breeding, inbreeding, genetic testing - Genetically modified crops - Hydroponics - Plant-based Pharmaceuticals
11.4 11.5	Plant Genetic Engineering	<ul style="list-style-type: none"> - Isolating and characterizing plant DNA - Modifying plant DNA, <i>Agrobacterim</i>, and Ti plasmid - <i>Arabidopsis</i> as a “model” organism
12.1 12.2	Drug Discovery Combinatorial Chemistry	<ul style="list-style-type: none"> - Medical biotechnology, drug development, drug discovery - Organic synthesis, combinatorial chemistry, parallel synthesis, screening
12.3	Peptide and DNA synthesis	<ul style="list-style-type: none"> - Peptide synthesizers - DNA synthesizers
12.4	Protein/Antibody Engineering	<ul style="list-style-type: none"> - Antibody specificity - Flow cytometry, vaccines
13.1	DNA Synthesis	<ul style="list-style-type: none"> - DNA synthesis in vivo - Chromosomes and homologous pairs - DNA replication and DNA polymerase - In vitro DNA synthesis
13.2	DNA Synthesis Products/Application	<ul style="list-style-type: none"> - DNA probes, primers - Southern blots - Microarrays
13.3	Polymerase Chain Reaction (PCR)	<ul style="list-style-type: none"> - Performing and analyzing a PCR reaction - Thermal cyclers - PCR optimization
13.4	Applications of PCR	<ul style="list-style-type: none"> - DNA fingerprinting, criminalistics, and more - VNTRs - Forensics
14.1	DNA Sequencing	<ul style="list-style-type: none"> - Reasons to sequence - Dideoxynucleotide sequencing - Sequencing results and “BLAST” - Human Genome Project
14.2	Genomics	<ul style="list-style-type: none"> - Genomics and bioinformatics - Other genome projects - RNA and genomics
14.3	Protein Studies	<ul style="list-style-type: none"> - Proteomics - X-ray crystallography, mass spectrometry, NMR, - ELISA, Western blots
14.4	Other Applications of Biotechnology (2 class meetings)	<ul style="list-style-type: none"> - Pharmacogenetics, personalized medicine - Environmental Biotechnology - Biodefense/Bioterrorism
	Course Final	