APPROVED: May 16, 2001

COURSE TITLE: Biotechnology

COURSE CODE: S0701p

GRADE LEVEL: 10 – 12 (16 years or older, if ROP)

COURSE LENGTH: One year

PREREQUISITE: Successful completion of Biology

CREDIT: 10 credits

UC/CSU CREDIT: Meets UC/CSU "d" requirement

GRADUATION REQUIREMENT: Fulfills one year of elective credit

STANDARD AND BENCHMARKS:
C: 1 a,d,e; 2 a-d; 3 c,d; 5 b-d; 6 a,b,d; 10 a-c, f
B: 1 b-d, 2 c-g; 3 a,b,d; 4 a-f; 5 a,c-e; 7 b; 10 b-d
E: 1 a-d, f, j, l, m

COURSE DESCRIPTION:
Biotechnology allows advanced biology students to further their studies in specific areas of biochemistry, genetics, microbiology, molecular biology, protein science, and immunology. The content and structure of this course will provide the student with a broad awareness of the science and the essential skills that lead to opportunities for employment within the biotechnology industry. Emphasis is placed on science attitudes, thinking process and skills, and applications of biotechnology to human affairs, medicine, and industry.

COURSE GOALS:
The student will:
1. Develop a strong academic foundation in the biosciences to prepare for the rigors of post-secondary courses including chemistry, biochemistry, biology, genetics, protein science, microbiology, and immunology.
2. Apply thinking and writing skills pertaining to scientific process including integration of scientific content that guides the student to investigation, experimentation, and proper data analysis ultimately leading to the development of logical conclusions.
3. Master fundamental skills/techniques in the manipulation of materials and equipment found in the biotech industry.
4. Be able to articulate orally and in writing, individual positions on ethical issues arising from advances in the field of bioscience.
5. Develop an awareness of current employment opportunities in the biotechnology industry and academia.

TEXTBOOK MATERIALS:

Primary Text
- Biotechnology, Demystifying the Concept. Bourgaize, Jewell & Buiser. Benjamin Cummings, 2000

Supplementary Text:
- Recombinant DNA and Biotechnology, Kruezer and Massey, 1996.
- DNA SCIENCE, Miklos and Fryer, Cold Springs Harbor Press, 1990
- Biosource Lab Program – Biotechnology, Holt, Rinehart and Winston, 1997
- Biology Principles and Exploration, Holt, Rinehart and Winston, 1998

TEACHER RESOURCES:
- Access Excellence website: www.accessexcellence.org
- Santa Clara Biotechnology Education Partnership materials website: **www.babec.org/SCCBEP**
- Bay Area Biotech Education Program (BABEC): supplemental materials and supplies
- Biotechnology website: www.bio.org
- Videos: GATTACA, selections from Annenberg: Cycles of Life,
- Laboratory materials from Biotech Education Program (BEP); Lawrence Livermore Laboratory
- Study kits

Acalanes Union High School District **Course Content and Performance Objectives**	SAT-9 T-2/3	HSEE	State Standards & Benchmarks*	Assessment[#]	Timeline[+]
1.0 Scientific Content Students will understand basic scientific concepts.					
1.1 Concepts in chemistry				Test	8%
1.1.1 Atomic and Molecular Structure	x		C:1a,d,e	Lab Project	
1.1.2 Covalent, Ionic and Hydrogen bonding			C: 2a-d	Teacher observation	
1.1.3 Stoichiometry			C: 3c,d		
1.1.4 Properties of acids and bases			C: 5b-d		
1.1.5 Solutions			C: 6a,b,d; B: 1h		
1.1.6 Organic chemistry and macromolecules of life			C: 10a-c,f		
1.2 Cellular Biology					
1.2.2 Properties of chemical reactions	x		B: 1b	Test Lab Report	6%
1.1.1 Compare and contrast prokaryotic cells, eukaryotic cells, and viruses			B: 1c, 10b-d	Lab Project	
1.3 Inheritance/physiology of genetic diseases			B: 2c-g		
1.3.1 Focus on Cystic Fibrosis, Sickle Cell Anemia, and Huntingtons disease			B: 7b	Presentation Test	2%
1.4 Mendelian Inheritance					
1.4.1 Determine the alleles in their genotypes of specific traits by comparing themselves to their parent's phenotypes.			B: 3b	Test Teacher Observation	3%
1.5 Probability				Test	
1.5.1 Constructing monohybrid punnet squares			B: 3a	Teacher Observation	2%
1.5.2 Constructing dihybrid punnet squares				Lab Report	
1.6 Pedigree analysis					
1.6.1 Sex-linked traits	x		B: 3d	Teacher Observation	2%
1.6.2 Dominant and Recessive traits	x				
1.7 DNA Biochemistry					
1.7.1 Function				Test	
1.7.2 Physical and chemical properties			B: 1d, 4a-e	Lab Report	20%
1.7.3 Replication				Lab Project	
1.7.4 Transcription and translation				Teacher Observation	
1.7.5 Genetic code					
1.8 Protein Biochemistry					
1.8.1 Structural levels			B: 4f, 5a,c	Test	20%
1.8.2 Relationship between structure and function				Lab Report	

	SAT-9 T-2/3	HSEE	State Standards & Benchmarks*	Assessment#	Timeline+
1.8.3 Uses of enzymes in industry and laboratory diagnostics.					
1.9 Gene Structure and Regulation					
1.9.1 5': promoters, transcription factors, signal sequences			B: 5d-e	Test	2%
1.9.2 3':termination, introns, exons, RNA splicing, coding regions, mutations and their consequences					
1.10 Gene sequencing				Teacher Observation	5%
1.11 History of Biotechnology					
1.11.1 Discoveries				Lab Project	2%
1.11.2 Important contributors					
2.0 Scientific Process Skills Students will demonstrate ability to use appropriate scientific processes.					
2.1 Gather information (descriptive and quantitative) needed for developing or testing inferences and hypotheses.	x				
2.2 Practice generating and recording data by observing, recalling, recognizing, identifying, and measuring.	x		IE: 1a-d,f,j	Lab Report	5%
2.3 Develop ability to organize data by comparing, ordering, classifying and relating.	x				
2.4 Apply and evaluate data and generate theories by hypothesizing, predicting, inferring, generalizing, theorizing, explaining, justifying and judging.					
3.0 Fundamental Laboratory Skills and Techniques Students will demonstrate ability to use appropriate laboratory skills.					
3.1 Effectively communicate (orally and in writing) scientific procedures and information.				Test Lab Report Teacher Observation	15% (ongoing)
3.2 Use the International System of Units (SI) metric system			IE: 1a-d,f,j		
3.3 Apply appropriate mathematical concepts and skills in interpreting data and solving problems.					
3.4 Assemble and use laboratory apparatus, tools, and materials in a skillful manner, giving due attention to					

	SAT-9 T-2/3	HSEE	State Standards & Benchmarks*	Assessment#	Timeline+
safe laboratory practices.					
4.0 Advances and Ethics in the Biotechnology Field Students will understand current advances in the field of biotechnology and related ethical, legal and societal issues.					
4.1 Write abstracts of journal articles and orally present the contents. Actively participate in question and answer sessions.			IE: 1m	Lab Project Presentation	5% (ongoing)
4.2 Participate in discussions and defend personal position relating to ethical, legal and societal issues as a result of advancements in the field of Biotechnology.					
5.0 Economics of Biotechnology Students will understand economic issues related to advances in the field of biotechnology.					
5.1 Biotech applications in medicine					
5.2 Human Genome Project					
5.3 Biotech applications in agriculture and the environment					
5.4 Economic impact of biotechnology 5.4.1 Stock market investment and analysis 5.4.2 Patents				Lab Project Presentation	11%
5.5 Impact on society and future potentials					
5.6 Businesses and careers in the Biotechnology field					
5.6.1 Research and prepare a comprehensive report on biotech companies.					
5.6.2 Research careers and conduct interviews with individuals in the biotech industry. Present findings in a written report.					

* Standards & Benchmarks: C=Chemistry B=Biology IE= Investigation and Experimentation
\# Assessment: T=test LR= Lab Report LP= Lab Project P= Presentation TO= Teacher observation
\+ Timeline: Percentage of time on units may exceed 100% because many units overlap or are ongoing themes in the course

Acalanes Union High School District
Course Content and Performance Objectives

Laboratory Activities:

- Molecular models of macromolecules
- Micropipetting review
- Chromatography (paper, size exclusion, ion exchange, hydrophobic interaction)
- Gel electrophoresis (agarose and SDS-PAGE)
- Enzymes in Industry lab
- Spectrophotometry and protein determination assays
- Purification of DNA
- Restriction enzyme function and analysis on Lambda DNA
- Restriction analysis of DNA
- Ligation of plasmid DNA
- Restriction analysis of purified DNA
- Transformation of E.coli with recombinant DNA
- Protein extraction and purification
- PCR Alu activity
- ELISA and other immunoassays
- Bacterial staining and identification
- Fermentation and products of fermentation

Laboratory Skills:

- Use of pipets and micropipets
- Preparation of nutrient agar plates
- Bacterial streaking to single colonies
- Dilution series and bacterial plating
- Preparation of growth curves
- Bacterial transformation
- Agarose gel electrophoresis and analysis
- SDS-PAGE electrophoresis and analysis
- Use of restriction and ligation enzymes
- HIC Protein purification
- Use of spectrophotometer and fractionating
- Preparation of liquid and gel media
- Aseptic techniques

- Inoculation of liquid cultures
- Preparing solutions

GRADING GUIDLINES:

See AUHSD Grade Guidelines: Final Mark Rubric and Final Course Mark Determination Components.