General Education Course Proposal

Proposed Course: ~~GEL~~ NSCI 120 Biotechnology and Its Impact on Society Units 03
Prefix No. Title

Department: Biology School: Natural Sciences

GE Category (Indicate one category only):
Foundation: A1___; A2___; A3___; B4___
Breadth: B1___; B2___; C1___; C2___; D___; E___
Integration: B X ; C___; D___; International/Multicultural____

Existing Course___; Revised Course___; New Course X
Course Included in Current GE Program____
New courses require the Undergraduate Course Proposal form in addition to this form.
Revised courses require the Undergraduate Course Change Request in addition to this form.

Proposed catalog description: Limit course description to 40 words using succinct phrases. Include prerequisites, limitations, lecture/lab hours. Indicate former course number, e.g., (Former Biol 105)

Biotechnology and Its Impact on Society (3)
Prerequisites: completion of Physical Sciences (B1) and Life Sciences (B2) General Education course requirements; Courses in Biology and Chemistry (High School or College) strongly recommended. Introduction to the tools of modern biotechnology including recombinant DNA, gene therapy, cloning, monoclonal antibodies, DNA fingerprinting and the Polymerase Chain Reaction (PCR). Applications of biotechnology to medicine, agriculture, the environment and forensics, as well as their ethical implications, will be addressed.

Enrollment limit per section: 50
Expected number of sections per semester – Year 1 1 ; Year 3 2

Attachments:

1. A statement presenting the ways in which this course meets the Specifications provided in the appropriate section of the General Education Policy as well as in the Policies for Inclusion and Evaluation of General Education Courses.
2. A statement of elements common to all sections of this course, identifying content, objectives, required student activities, grading policy, representative texts, and an approximate schedule for the course. Required student activities include such things as papers, research projects, homework, laboratory and/or studio performance, recitations, participation, attendance, and exams.
3. A typical syllabus for a particular offering of the course.
4. Any special cost factors associated with this course.

Approval for Inclusion in General Education

[signature]	5/15/98	[signature]	9/22/98
Department Chair	Date	School Curriculum Committee	Date
[signature]	9/22/98	[signature]	12/15/98
School Dean	Date	General Education Subcommittee	Date
[signature]	12/22/98		
Associate Provost	Date		
Howard K Ono	12/15/98		
Department Chair	Date		

Attachment #2

Common Elements to the All Course Sections

The goal of this lecture/discussion course is to have students become familiar with the basic elements of Biotechnology as a discipline and to develop skills for making informed choices about societal options regarding biotechnology processes and products. Critical evaluation of information sources used by the lay public will be emphasized to prepare students for assessing future developments in this rapidly changing field. The examinations will focus on broad disciplinary awareness; a term paper, using sources from scholarly research, will be required to achieve greater depth of inquiry into a single issue. Hard scientific support will be a key element of the term paper. Class participation in discussions is expected.

CURRICULUM OUTLINE

I. Origins of Biotechnology
   - A. Historical versus Modern Uses of Biological Processes

II. Core Concepts of Cellular and Molecular Biology
   - A. Cell Biology
     1. Cell Structure and Function
     2. Prokaryotic and Eukaryotic comparisons
   - B. Fundamental Genetic Concepts
   - C. DNA as the Genetic Material
     1. DNA structure and function
   - D. Protein Structure and Function
   - E. The Genetic Code
   - F. Gene Expression

III. Genetic Engineering Toolbox
   - A. Recombinant DNA Technology--Gene Cloning
     1. Restriction Enzymes
     2. Transformation
     3. Markers of Gene Expression
   - B. Cloning of Plant and Animal Cells
     1. Transfection
     2. Transgenic organisms
     3. Ethical Issues of Cloning Whole Organisms
   - C. Monoclonal Antibody Technology
     1. Selective Cloning by the Immune System
   - D. DNA Probes and DNA Fingerprinting
     1. Blotting Techniques
     2. Reverse Genetics
     3. Ethical Issues on Privacy
   - E. Polymerase Chain Reaction
     1. Selective Molecular Cloning of Individual Genes

IV. Applications of Biotechnology
    A. Medicine
        1. Designer Drugs
            a. Drugs from Microbes, Plants and Marine organisms
            b. Exploitation Issue-- Developing Countries' Genetic Wealth
            c. Ethics of Patents and Profits from "Life"
            d. Resistance--Are we making it worse?
        2. Vaccines
        3. Monoclonal Antibodies
            a. Diagnostics
            b. Therapeutics
            c. Abzymes
        4. Human Genome Project
            a. Biodiversity, Eugenics, Prejudice and Ethics
        5. Gene Therapy
            a. Ethics related to Somatic vs. Germ Line Therapy
        6. Transplantations
            a. More "Clone Wars"
    B. Agriculture
        1. Pest/Disease Control
            a. Agricultural Practices--Economic Impacts?
        2. Transgenic agronomy/forestry
        3. Farmer-ceuticals
    C. Environment
        1. Clean-up
            a. Bioremediation
            b. Phytoremediation
        2. Mining
        3. Fuel Production
V. Additional Ethical Issues of Biotechnology
    A. Safety
        1. Food and Nutrition
        2. Perturbed Environmental Ecology
        3. Engineered Gene Transfer to Wild Organisms
    B. Health Care Delivery Options

ASSESSMENTS:

Examinations

Newspaper/News Magazine Article Summaries and Critiques--Each student will identify a lay media article related to Biotechnology, explain its connection to biotechnology, and summarize and critique its scientific veracity and societal impact based on student's knowledge to date. One assignment will occur early in the semester and one or two during the latter portion of the semester.

Internet Search for compiling a bibliography of Web sites related to a specific biotechnology topic area. Compare and contrast the information from five sites relevant to the issue. Critique the veracity of the sources and identify bias, if any, in the presentation of material at these five sites--Who do you trust and why?

Research Term Paper (about 10 pages) on a biotechnology topic approved by the instructor. A defined minimum number of scholarly bibliographic citations will be required by the instructor to insure a "C" grade on the assignment.

Classroom participation of discussion is expected.

GRADING:

Defined achievement levels for specific grades will be identified by the instructor. In general there will be a balance of credit given for examinations, classroom participation and written project assignments. All assignments must be turned in to pass the class. Deadlines for the assignments will be announced by the instructor and late assignments will have their value reduced by 10% per school day. University Policies on Plagiarism or Cheating will be enforced.

REPRESENTATIVE TEXT:

Biotechnology Unzipped: Promises and Realities by Eric S. Grace, John Henry Press, Washington D.C. 1997, 247 pages.

SUPPLEMENTAL MATERIALS:
Selected readings from other appropriate texts:
The Code of Codes: Scientific and Social Issues in the Human Genome Project edited by D.J. Kevles and L. Hood, Harvard University Press, Cambridge MA, 1993, 397 pages;
Genethics:The Clash between the New Genetics and Human Values by D. Suzuki and Knudtson, Harvard University Press, Cambridge MA, 1990;
Due Consideration: Controversy in the Age of Medical Miracles by Arthur Caplan, John Wiley Press, New York, NY, 1997, 282 pages.
Current News articles and brief research summaries and critiques;
Video Presentations

BIOTECHNOLOGY AND SOCIETY--COURSE SYLLABUS

1998

INSTRUCTOR: DOLLY EWE

TEXTBOOK: BIOTECHNOLOGY UNZIPPED: PROMISES AND REALITIES, E. GRACE, JOSEPH HENRY PRESS, 1997

COURSE OBJECTIVES: THE COURSE WILL INTRODUCE THE STUDENT TO THE SCIENTIFIC CONCEPTS IN BIOTECHNOLOGY INCLUDING A GENERAL INTRODUCTION TO MOLECULAR BIOLOGY. THE LANGUAGE AND TERMINOLOGY OF THE FIELD WILL BE PRESENTED AS WELL AS DISCUSSIONS OF THE SCIENTIFIC TOOLS AND TECHNIQUES AVAILABLE. THE COURSE WILL DISCUSS THE APPLICATIONS OF BIOTECHNOLOGY TO FIELDS SUCH AS MEDICINE, AGRICULTURE, AND THE ENVIRONMENT AND THE IMPORTANT ETHICAL ISSUES BROUGHT UP BY THE BIOTECHNOLOGICAL REVOLUTION.

CLASS SCHEDULE

WEEK	DATES	CHAPTER	TOPICS
1		1	IN THE BEGINNING
2		1	DNA, PROTEINS AND THE GENETIC CODE
3		2	TOOLS IN THE GENETIC ENGINEERING WORKSHOP
4,5		2 7 (P.197-206)	CLONING, PROBES, FINGERPRINTING, PCR AND ETHICAL ISSUES--PATENTS AND PROFITS
6,7		3 7 (P. 213-8)	GENES, GENE THERAPY AND THE HUMAN GENOME PROJECT. ETHICAL ISSUES OF GENE THERAPY (ARTICLE SUMMARY DUE)
8		3	MEDICINES, VACCINES AND DESIGNER DRUGS **EXAMINATION #1** (CH 1, 2)
9		4	BIOTECHNOLOGY ON THE FARM
10		4	PESTS, DISEASES, AND FARMER-CEUTICALS
11		5	MICROBES FOR CLEAN UP, AS MONITORS AND IN MINING (TERM PAPER TOPIC DUE)
12		5	NEW CHEMICALS AND FUELS (WEB SITES EVALUATION)
13		6	BIOTECHNOLOGY IN SEAS AND TREES **EXAMINATION #2** (CH 3, 4, 5) (TERM PAPER DRAFT DUE)
14		7	ETHICAL ISSUES--ENVIRONMENTAL, FOOD, AND HEALTH SAFETY
15			CONCLUSIONS AND FUTURE ISSUES (COMPLETED TERM PAPER DUE.)
16			**FINAL EXAMINATION**

WRITTEN ASSIGNMENTS

THERE WILL BE THREE WRITTEN ASSIGNMENTS:

1. FIND TWO ARTICLES FROM THE POPULAR PRESS (NEWSPAPERS, MAGAZINES, THE INTERNET, ETC.) COVERING AN INNOVATIVE TECHNIQUE IN BIOTECHNOLOGY. SUMMARIZE THE ARTICLES AND DISCUSS THE BENEFITS AND PROBLEMS CAUSED BY THE TECHNOLOGY. (MINIMUM 300 WORDS EACH)

2. SEARCH THE INTERNET FOR WEB SITES THAT PRESENT OPINIONS ABOUT A CONTROVERSIAL BIOTECHNOLOGY TOPIC. (FOR EXAMPLE, CLONING HUMAN ORGANS, USING ANIMALS TO PRODUCE DRUGS, CLONING A HUMAN BEING, GENE THERAPY, PRODUCING TRANSGENIC ORGANISMS, ETC.) FIND AT LEAST FIVE WEB SITES RELATED TO YOUR TOPIC (BOTH PRO AND CON). EVALUATE THE SITES FOR HONESTY, SCIENTIFIC ACCURACY, RELIABILITY, ETC. LIST THE SITES AND WRITE A PAPER SUMMARIZING YOUR CONCLUSIONS ABOUT EACH OF THE SITES. WHICH ONES DO YOU TRUST THE MOST AND WHY? (600 WORDS MINIMUM)

3. TERM PAPER. SUBMIT A TERM PAPER ON A BIOTECHNOLOGY TOPIC. (1500 WORDS MINIMUM). FURTHER DISCUSSION OF THE TERM PAPER WILL OCCUR DURING THE CLASS. THE GENERAL TOPIC SHOULD BE GIVEN TO THE INSTRUCTOR BY THE NINTH WEEK OF THE SEMESTER.

GRADING CRITERIA

THREE EXAMINATIONS (100 POINTS EACH)			300 POINTS
ARTICLE SUMMARIES			20 POINTS
WEB SITES			30 POINTS
TERM PAPER			50 POINTS
TYPICAL GRADING SCALES ARE:	A	=	90%
	B	=	75%
	C	=	60%
	D	=	50%

WRITTEN ASSIGNMENTS WILL LOSE 20% OF THEIR VALUE FOR EVERY PERIOD LATE. AS A RULE, MISSED EXAMINATIONS CANNOT BE MADE UP BUT THE INSTRUCTOR WILL CONSIDER EACH SITUATION ON A CASE BY CASE BASIS.

CHEATING AND PLAGARISM POLICY AND SERVICES FOR STUDENTS WITH DISABILITIES

THE OFFICIAL UNIVERSITY POLICIES WILL BE FOLLOWED. PLEASE SEE THE UNIVERSITY CATALOG AND SCHEDULE OF CLASSES FOR INFORMATION.

Biotechnology and Society

Congruency with Area B Objectives for an Upper Division, Integrated Course

GE Specification	Content Topics	Sample Readings	%Time
Imparting Knowledge of Facts and Principles of Living and Non-living Systems	1] Old/New Technology	*Unzipped*, Chap. 1	4.4%
	2] DNA; Protein; Genetic Code	*Unzipped*, Chap. 1	11.1%
Promote Understanding and Appreciation of the Methodologies of Science	1] Genetic Engineering	*Unzipped*, Chap. 2	6.7%
	2] Cloning, Monoclonal ab	*Unzipped*, Chap. 2	4.4%
	3] Probes, Fingerprinting, PCR, Forensics	*Unzipped*, Chap. 2 Simpson Trial Articles	6.7%
	4] Human Genome Project; Gene Therapy/Transplants	*Unzipped*, Chap. 3	6.7%
	5] Designer Drugs/Vaccines	*Unzipped*, Chap. 3	4.4%
	6] Agricultural Biotech	*Unzipped*, Chap. 4	8.8%
	7] Environmental Biotech	*Unzipped*, Chap. 5	6.7%
	8] Energy and Fuels	*Unzipped*, Chap. 5	6.7%
	9] Forest & Ocean Biotech	*Unzipped*, Chap. 6	6.7%
Attention to the Influence of Science on World's Civilizations	1]Patents, Profits, Ethics	*Unzipped*, Chap. 7 *Genethics*	4.4%
	2] Gene Therapy, Animal Cloning, Diagnostics--Ethical Issues	*Unzipped*, Chap. 7; *The Code of Codes;* *Due Considerations*	8.8%
	3] Safety of Food, Health and the Environment	*Unzipped*, Chap. 7 Selected News Articles	6.7%