



An Evaluation of Genetics 308 / 508X

BIOTECHNOLOGY

In Agriculture, Food and Human Health

On-line Course - Fall 1997

Iowa State University

Peter M. Loyd



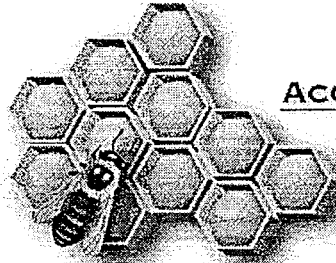
My Involvement with the Course

◆ Access Excellence

- ◆ Genentech, Inc.'s project to enhance high school biology education
- ◆ seminar presentation, Fall 1996



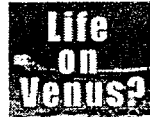
Access Excellence by Genentech



ACCESS EXCELLENCE®
G E N E N T E C H

A Place in Cyberspace for
Biology Teaching & Learning

Hot Stuff



Search

Access Excellence is a national educational program sponsored by biotechnology industry pioneer, Genentech, Inc. AE puts high school biology teachers in touch with scientists, colleagues, and vital sources of new scientific information through its online network. It's a virtual beehive of activity!

Activities Exchange

Biology-related activities and classroom projects developed by teachers

What's News

Weekly science reports, interviews with news-making scientists, and fun factoids!

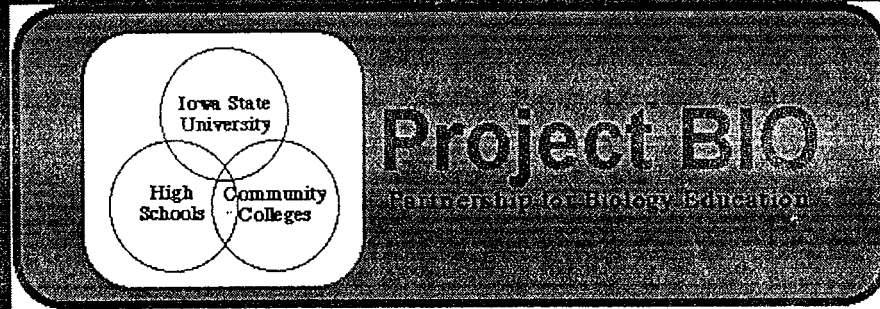


How the Course was Developed

- ◆ Startup in Spring of 1996
 - ◆ Funding through Project BIO and Zoo/Gen Department
 - ◆ Tom Ingebritsen, Professor of Zoo/Gen
 - ◆ Peter Loyd, Visiting Master Teacher, with funding through the H.H.M.I.



◆ Funded through Dept. of Zoo/Gen
and Project BIO funds





Target Audience

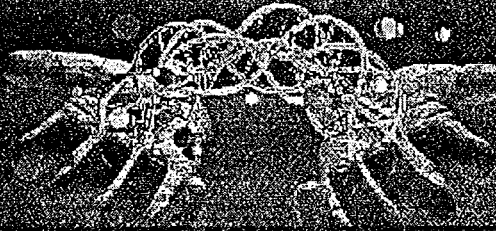
- ◆ aiming for HS and CC teachers
- ◆ undergrads w/ at least an intro bio course
- ◆ science industry employees
- ◆ ok for AP Bio HS students



DNA TECHNOLOGY THE AWESOME SKILL

BY EDWARD ALCAMO

- ◆ Text by Alcamo, SUNY Farmingdale
- ◆ accessible for non-majors, Sci. Am. style
- ◆ published 1996, 304 pages, ~\$50





◆ Spr./Summer 1996: Creation of Course

- ◆ Staff: Tom, Pete, and 2 undergrads
- ◆ Software tools: PageMill/Homepage (HTML creation), Photoshop, Freehand (graphics), RealAudio(online sound)
- ◆ Advertisements sent out
 - ◆ by post and on the web





Course Modules

- ◆ Module 1 - Introduction to Biotechnology (1 week)
- ◆ Module 2 - Principles of Molecular Biology (2 weeks)
- ◆ Module 3 - Genetic Diseases (5 weeks)
- ◆ Module 4 - Pharmaceutical Products (4 weeks)



Course Modules

- ◆ Module 5 - Agriculture and Food (3 weeks)
- ◆ Module 6 - Human Genome Project and Gene Therapy (3 weeks)



Who Took the Course and Why

- ◆ 25 students sign up
 - ◆ mainly HS and CC teachers, mostly from Iowa
 - ◆ biotech/industry employees
 - ◆ "civilians"
 - ◆ a few auditors
 - ◆ students come from Calif. to Penn.
- ◆ Why?



Assignments

- ◆ Introductions
 - ◆ The Discussion Forum/ Interaction Area
- ◆ Cloning by Computer
 - ◆ doing what real scientists do online
- ◆ Going On-line
- ◆ Wonderful Web Sites



Pharmaceutical Products Lecture

- ◆ Graphically Intensive Interface vs. the "trimmed down" version
- ◆ the problems with "slow" modems

Pharmaceutical Products of DNA Technology

LOOKING AHEAD

One of the most useful applications of DNA technology is in the pharmaceutical industry. This lecture explores the range of pharmaceutical products that can be manufactured through DNA technology. After completing the chapter, you should be able to:

- understand how being deficient in proteins such as insulin, human growth hormone, and Factor VIII contributes to ill health, and how DNA technology can be adapted by the biochemist to produce these proteins;
- appreciate some of the biochemical problems encountered in producing pharmaceutical products by DNA technology, and recognize how biochemists can circumvent these dilemmas.



Retrieving the human insulin gene from Gen Bank

- ◆ Students collect gene sequences from the web and manipulate them



National Center for
Biotechnology Information

Search GenBank

Type your search query in the box labelled "Search Keyword".

For example: *cyp and neuropeptide*

This is a searchable index. Enter search keywords:



Researching an Ag ELSI topic

◆ Ethical, Legal, and Social Issues

Agricultural Biotechnology ELSI Assignment

Instructions

- Pick one of the Ag Biotech products from the list below
- Write a one page report about ELSI issues associated with the product
- Your report should
 - Summarize the positive and negative arguments about the product
 - State your position about the product (i.e. for or against)
 - Justify your position

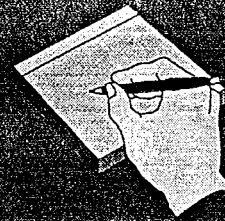
Ag Biotech Product Options

- Bovine somatotropin (bST)
- Flavr Savr[™] tomato
- Roundup[™] resistant soybeans
- BT-corn or cotton



Student Evaluation of Course: Pro's and Con's of On-line Work

- ◆ solicited before grades given out
- ◆ evaluation counted as a bonus assignment
- ◆ consisted of machine scored questions and free response written comments
- ◆ students evaluated:
 - ◆ assignments and lectures
 - ◆ interaction
 - ◆ technology
 - ◆ overall course





Evaluations of Assignments

◆ 1. Introductions:

- ◆ Educational Value: 3.07* (1-5)
- ◆ Difficulty Rating: 1.64* (1-3)

◆ 2. Virtual Fly Lab:

- ◆ Educational Value: 4.00 (2-5)
- ◆ Difficulty Rating: 3.46 (2-5)



◆ 3. Polymerase Chain Reaction(PCR):

◆ Educational Value: 3.31 (1-5)

◆ Difficulty Rating: 3.33 (3-4)



◆ 4. Genetic Diseases:

◆ Educational Value: 4.23* (3-5)

◆ Difficulty Rating: 3.54 (2-5)



◆ 5. Huntington's Disease:

- ◆ Educational Value: 4.07 (2-5)
- ◆ Difficulty Rating: 3.77* (1-5)

◆ 6. DNA Fingerprinting Lab Simulation:

- ◆ Educational Value: 3.62 (1-5)
- ◆ Difficulty Rating: 3.08 (2-4)



◆ 7. Cloning by Computer:

- ◆ Educational Value: 3.43 (2-5)
- ◆ Difficulty Rating: 3.67 (2-5)

◆ 8. Transformation Lab Simulation:

- ◆ Educational Value: 3.38 (2-5)
- ◆ Difficulty Rating: 3.17 (2-4)

◆ 9. Pharmaceutical Homework Activity for Group Enrichment (PHAGE):

- ◆ Educational Value: 3.90 (3-5)
- ◆ Difficulty Rating: 3.50 (2-5)



◆ 10. Ag Biotech Ethical, Legal, & Social Implications (ELSI):

◆ Educational Value: 3.58 (1-5)

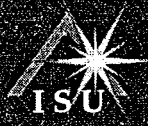
◆ Difficulty Rating: 3.15 (2-5)



◆ 11. DNA Sequencing:

◆ Educational Value: 3.60 (2-5)

◆ Difficulty Rating: 3.27 (2-4)



Evaluation of Lectures

- ◆ Information on Slides: 3.23 (2-5)
- ◆ Information in the Audio: 3.23 (3-4)
- ◆ Amount of Graphics in lectures: 3.15 (3-4)



Evaluation of Reading Material

- ◆ Educational value of text: 4.45 (4-5)
- ◆ Ease of Reading: 3.80 (3-5)
- ◆ Educational value of Biotech
- ◆ Information Series: 4.36 (3-5)



Balance of Learning Activities

◆ Lectures:	3.36	(2-5)
◆ Homework Assignments:	2.9	(1-5)
◆ Reading Material:	3.27	(1-5)



Interaction

- ◆ Overall value of interaction
 - ◆ with classmates: 3.07 (1-5)
- ◆ Value of the Disc. Forum: 2.69 "
- ◆ Value of the Listserve: 2.84 "
- ◆ Value of the Class list: 3.07 "
- ◆ Value of HD cooperative
 - ◆ learning assignment: 3.23 "



Technology

◆ Computer used to access the course:

- ◆ Macintosh Power PC 4 students
- ◆ 486 IBM clone 1
- ◆ Pentium PC 8

◆ How did you access the course?

- ◆ Internet Service provider 4
- ◆ Dedicated connection 1



◆ Where did you access the course?

- ◆ Home 5
- ◆ Office 4
- ◆ Library 2
- ◆ Area Education Agency 1

◆ Connection Speed:

- ◆ 14.4 modem 3
- ◆ 28.8 modem 3
- ◆ >28.8 dedicated line 3



◆ Computer skills:

- ◆ before the course: 3.23 (1-5)
- ◆ after the course: 3.85 (3-5)



◆ WWW/Internet skills

- ◆ before the course: 2.15 (1-4)
- ◆ after the course: 3.92 (3-5)



What Students Liked Best

- ◆ Course content
- ◆ Convenience
 - ◆ access at any time through the Internet
 - ◆ replay lectures, copy class notes
 - ◆ no driving to class
- ◆ Exposure to new technology





What Students Liked Least

- ◆ Lack of interaction / feedback
 - ◆ with instructors and classmates
 - ◆ regarding HW and exams
- ◆ Computer Difficulties
 - ◆ frustration with Internet connectivity
- ◆ Too much work for 2 credit hours
 - ◆ most mentioned 3 credits





Advantages of an On-line Course

- ◆ Convenient Distance Education
- ◆ Independent research and/or collaborative work...some day
- ◆ Exposure to new technology



Disadvantages of an On-line Course

- ◆ Computer and Internet frustration
- ◆ Lack of interaction
 - ◆ With peers and instructor
 - ◆ Homework and exam feedback



Suggestions for improvement

- ◆ Prepare student for what's ahead better
 - ◆ pre-enrollment advertising of course
 - ◆ Internet intensive nature of course
 - ◆ Browser and Searching familiarity
 - ◆ new student course advice/help areas
 - ◆ improved and expanded FAQ's
 - ◆ stress importance of reading and responding to email



Suggestions

- ◆ course needs more critical thinking exercises and less rote work
 - ◆ more on ELSI
 - ◆ less PCR / DNA sequencing repetitive work



What I Have Gained at ISU

- ◆ vastly improved knowledge of the Internet, software, HTML, and teaching resources for biology
- ◆ increased awareness of pro's and con's of the Internet as a teaching tool
 - ◆ not the panacea the hype would lead one to believe...but pretty darn close
- ◆ improved teaching skills and greater enthusiasm



What does the future hold?

- ◆ Once the technology improves:
 - ◆ On-line courses will vastly increase in number and subject area - allowing millions to use Distance Education
 - ◆ fierce competition for this market?
 - ◆ price will decrease dramatically?
 - ◆ commercial ventures to supply courses?
 - ◆ will universities supply courses or just content?
 - ◆ job creation



Acknowledgments

- ◆ Thanks to:
 - ◆ the members of my Program of Study Committee
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 - ◆ Chris Minor