

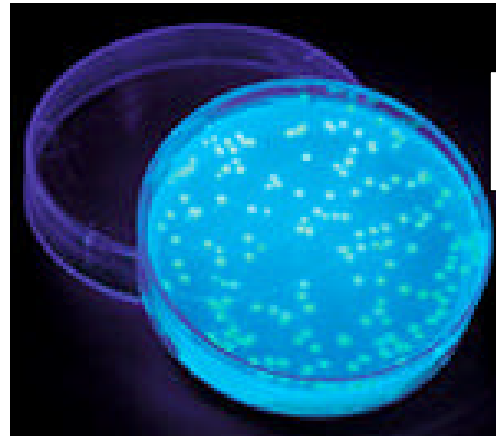
## Kast Fund Report 2001

### US Biology

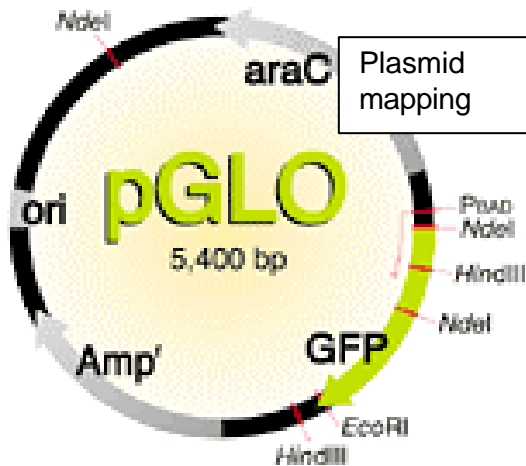
#### The Development of a New Upper School Science elective: Selected Topics in Biotechnology

The purpose of this project was to lay the foundation for a new Biology elective at Germantown Academy, "Selected Topics in Biotechnology." **Biotechnology** is commonly defined as, "The use of living organisms or their products to enhance human health and the human environment and the application of organisms, biological systems, or biological processes to manufacturing and service industries.

Any process in which organisms, tissues, cells, organelles, or isolated enzymes are used to convert biological or other raw materials to products of greater value, as well as the design and use of reactors fermenters, downstream processing, analytical and control equipment associated with biological manufacturing processes." The focus of the course will be to touch on many of the points presented in this definition, through laboratory based activities, and Internet-based research projects.



PGLO bacterial transformation



The project began in the summer of 2001 and involved the following major components: reading reference materials (books, magazine articles, web-based materials) locating lab-based activities, performing selected activities, attending a major conference (Biotechnology 2001 at Virginia Tech), and beginning to design a website for student use. The majority of time was spent reading and outlining the books to be used for the course (student and teacher reference), as well searching the Internet for

resources for both the student and teacher. The students will read a current non-fiction book called *Genome*, by Matthew Ridley. Questions for each of the chapters were prepared for this as well. The distance learning aspect of the course has just begun to be set into place. I know that this will take some time to perfect and learn the technology to make it useful for the students.

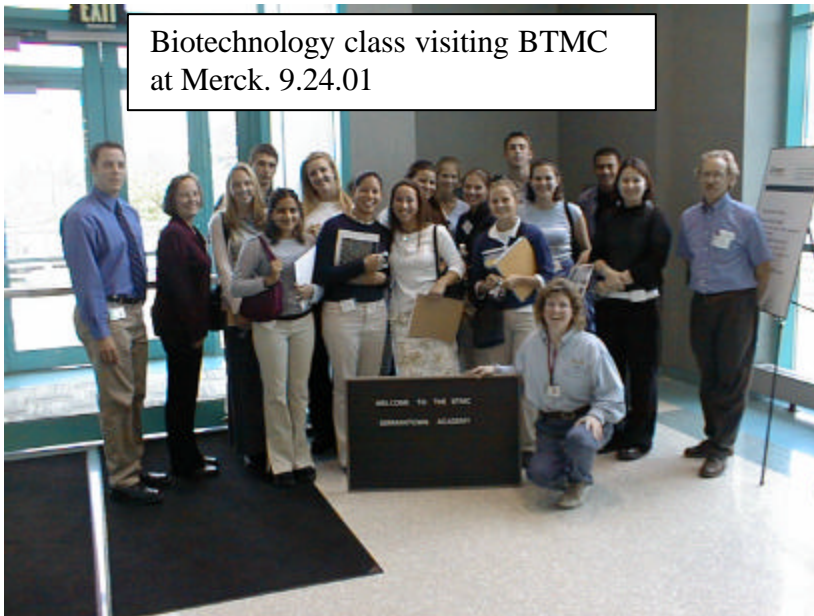
Diversity of Fish Proteins  
using PAGE to determine  
Evolutionary connections



I would like to express my sincere thanks to the Barra Foundation for the funding to pursue this fascinating area of Biology, as well as the selection committee at Germantown Academy. This project was a huge experiment, which through constant revision is amended. I learned a great deal and I will continue to look for ways to supplement my existing plan. I would also like to recognize colleagues that have been very helpful, as well as the current, and first class of GA Biotechnology students.

These two groups include: Joseph Scherrer, Benjamin Olshin, Joseph Rozak, Brian Alexa, Anush Bala, Sara Beltz, Kira Bryers, Quinn Cunningham, Laura Finney, Paul Hermany, Roxanna Hernandez, Victoria Kimball, Jessica Prince, Rachel Rogers, Christine Saunders, Elizabeth Shaner, and Anand Vankawlala.

Biotechnology class visiting BTMC  
at Merck. 9.24.01



Lastly I would like to thank my wonderful family- my husband, Pepper Pizzino and my children, Corey and Josie.

## References-

The following is a list of resources that were read/viewed in preparation for the new course:

### A. Books:

Text book: *Recombinant DNA and Biotechnology A Guide for Students* 2<sup>nd</sup> edition, 2001, by Helen Kreuzer and Adrienne Massey

*Genome* by Matthew Ridley

*The Coming Biotech Age (The business of Bio-Materials)* by Richard W. Oliver

*Biotechnology Unzipped*, by Eric Grace

*Bioethics*

### B. Movies:

Current Sci-Fi Movies

*GATTACCA*

*The 6<sup>th</sup> Day*

Science/News movies

*Harvest of Fear*, produced by Frontline

*Organ Farm*, produced by Frontline

*Cracking the Code of Life*, produced by PBS

### C. Websites:

I have these are organized by subject matter, and there are over forty websites. I will be glad to supply the lists if requested to do so. Some of these can be seen on the website/assignment lists for the students at

<http://www.ga.k12.pa.us/academics/us/TECHsite/STBsite/index.html>

The following is a course outline including textbook references, lab activities and supplementary audio-visual materials. The laboratory activities in red are those that were completed during the summer in preparation for the course.

The website for the course can be found at:

<http://www.ga.k12.pa.us/academics/us/TECHsite/STBsite/index.html>

Topic/Unit	Text book pages/topics	Genome chap	Involved Labs/Activities	Videos/other
I. Introduction to Biotechnology A. Overview	Chapter 1-An Overview of Biotechnology		Web based Assignment– Applications of Biotech	Pfizer-Mass production of Chymax (first approved enzyme/RDNA origin for food use)
B. Fermentation			<b>Making Homemade Soda using fermentation</b>	(Websites- history and use of fermentation )
			Microbes Production Antibiotics  Web/Research Assignment- Researching one of the current drugs in the biotech pipeline and designing an advertisement	Field Trip- To Merck's Biotechnology Manufacturing complex
C. History- The Road to Biotechnology		Chap 3 History	Web/Research Assignment- Constructing a Timeline for the Classroom	Use Human Genome Project CD and websites produced by NIH
II. DNA Structure and Function  Molecular Genetics	Review Part of Chap 3 (Genes, Genetics, and Geneticists) and Chap4 (an Overview of Molecular Biology)	Foreward Intro Chap. 1 Life  X and Y Conflict  9 Disease	Isolation/extraction DNA- Wheat Germ, thymus, and Yeast- students design own experiment  Intro to Human Genome Project- Its Science, Applications and Issues  Adventures in Dog Hair Parts I and II (and use of website VetGen)  Isolation of Bioluminescent Bacteria from Natural Sources- Autoinduction-Unique examples of gene expression/mutualism  Human Molecular Genetics- case studies Sickle Cell and PKU	Video- <i>Cracking the code</i> Segments on web  HGP cd rom and Website

III. Manipulation and analysis of DNA		Chap 8 Self Interest	Restriction exercises in text- including plasmids and mapping  Restriction Digest /analysis Lambda DNA (Biorad)	V- Introduction to electrophoresis
			Activity 19 in text DNA typing  Mapping restriction sites on plasmids (Edvotek)	
	BINDER Forensics  Readings- famous forensic cases involving DNA profiling		DNA fingerprinting dry lab (Edvotek)  PCR activity18 in text  Chromosome 8 PCR (Biorad)	Video PCR (website DNALC)
			Activity- fishing for DNA p. 235 and 237  Southern Blot –DNA fingerprinting (Edvotek)	
			DNA sequencing (dry lab) Edvotek  And activity 17 in text	
		Chap 2 Species Chap 14 Immortality	Readings in text and 2 activities p. 260 ish  mtDNA (Carolina) extract, amplify, separate, send away to sequence	Human Origins- DNALC website
Transfer of Genetic Information Bacterial transformation			Lumni bacteria from fish (Fisher)  PGLO lab biorad AND Purification of GFP using column chromatography  Group Project- Design and Market an Original Biotech Product	

B. GMO	Chap 25/26  Article- cloning on the farm Use biotech unzipped  Student Activities 34, 35, 36	Chap 18 Cures	Soybeans and Roundup resistance (Fisher)	<i>Harvest of Fear</i>  <i>Organ Farm</i>
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V. Bioinformatics and Evolutionary analysis of proteins	See AM bio teacher Aug 2001		<b>Protein Fingerprinting</b> <b>VERTICAL electrophoresis</b> <b>Fishy (Biorad)</b>	Video- <i>Evolution</i> PBS
			Amylase (Carolina) AND in text  BLAST activities see text Activities 27 – 30  <b>TIGR activity</b>	
IV Bioethics	Part III Societal Issues  Case 2 HD  Student Activities 37, 38, 39	Chap 4 Fate-  Chap 21 Eugenics	Activities/ Bioethics Case studies from following sources: Kennedy Institute of Bioethics NIH Human Genome Project CD	Cold Spring Harbor video  <i>GATTACCA</i> movie or  <i>6<sup>th</sup> Day</i>  DNALC Eugenics!