



Strategies to introduce quantitative skills in the Biology curriculum

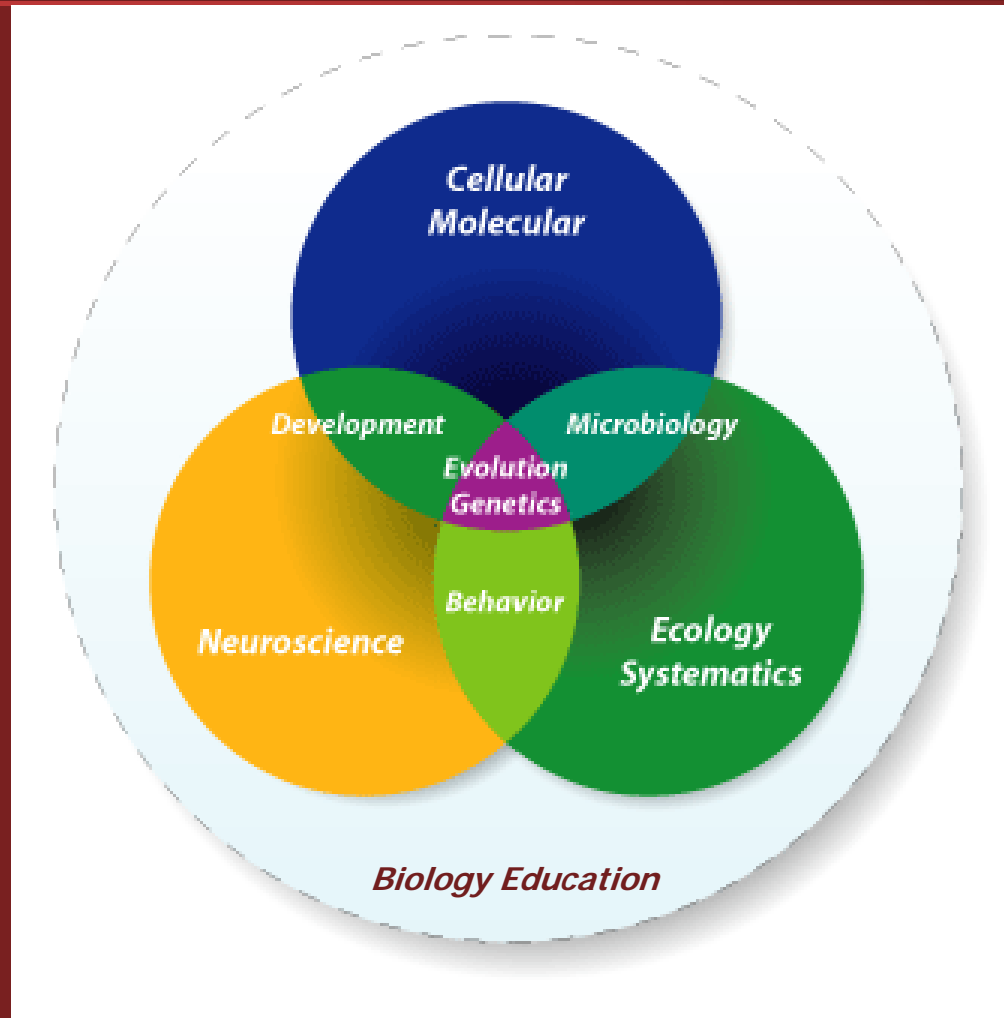
Dr. Michelle Borrero
University of Puerto Rico
Rio Piedras Campus

University of Puerto Rico Río Piedras Campus



- Hispanic-serving Institution
- Research Comprehensive Institution
- Over 22,000 undergraduate students
 - 98% from Puerto Rico
 - 1% from the United States
 - 1% from other Latin American countries.
- Approximately 4,000 graduate students

Department of Biology



Strategies that are used in the curriculum



- Problem-based learning
- Active learning
- Independent laboratory
- Internet-accessible curricular materials
- Library project studies
- Tutoring and mentoring

New curricular scheme 2007-08



■ Molecular & Cellular Biology

- Provide a curriculum to prepare biologists with a strong background in the concepts and methods that will allow them to contribute to the discipline in the 21st century
- It requires the integration of the physical and chemical sciences with Genetics and Molecular Biology

■ Integrative Biology

- Provide a curriculum that will allow students to understand patterns that govern biological organization
- It requires a strong emphasis on Genetics, Evolution, Ecology and the Structure and Function of living things.

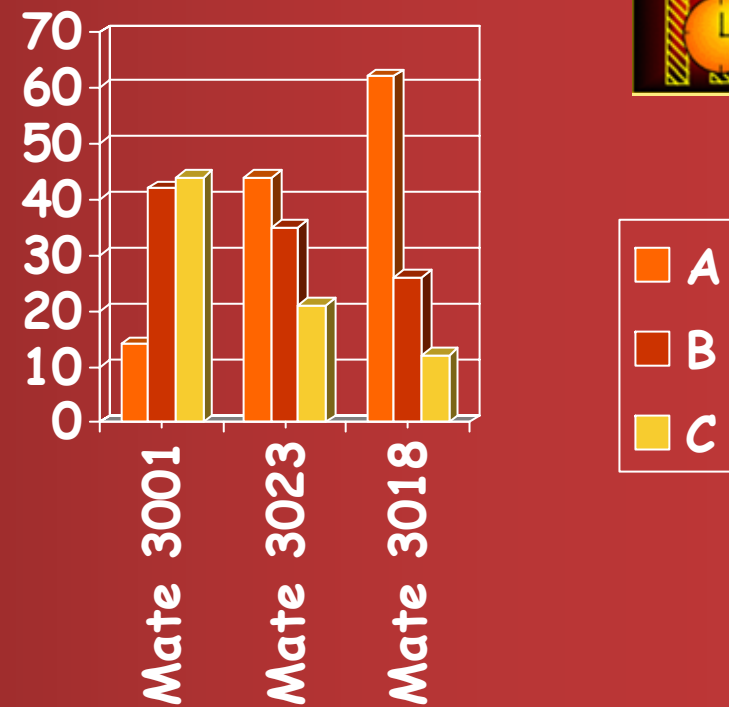
Changes in the new curriculum



- Calculus I
 - Math Summer Immersion Program
- Quantitative pre-requirements for Biology courses
 - General Biology
 - Genetics
- All undergraduate laboratories
- Language proficiency in both English and Spanish

Math Immersion Program

- Goal: Prepare students to enter to the Calculus I course on their first semester of freshman year



*84% of students enrolled
pass at least one level



General Biology I changes



■ Lecture

- Eliminate the atom, etc.
- Start with water; include pH
- Introduce cell communication
- Further develop genetics; include probability
- Introduce genetic engineering and biotechnology
- Further develop population genetics; include Hardy-Weinberg

General Biology I changes

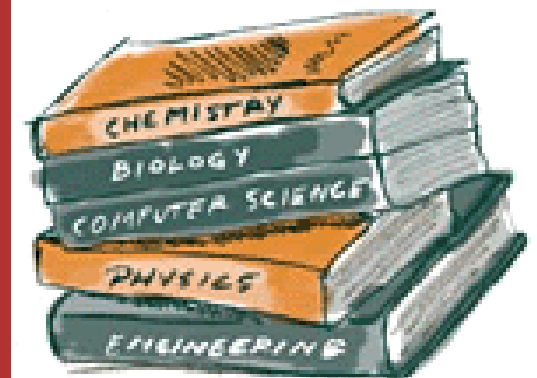


■ Laboratory

- Introduce exercises that are “open ended investigations”
- Emphasize data gathering, analysis and presentation
- Use of computers to analyze and present the data
- Introduce basic concepts of statistics (ex. mean, standard deviation)
- Introduce reports that are like research articles
- Introduce the development of information and technology skills
- Introduce protein visualization to study protein structure
- Update the biotechnology exercise
- Introduce the preparation of solutions to be used in the lab

Upper-level laboratories

- Molecular Biotechnology Lab



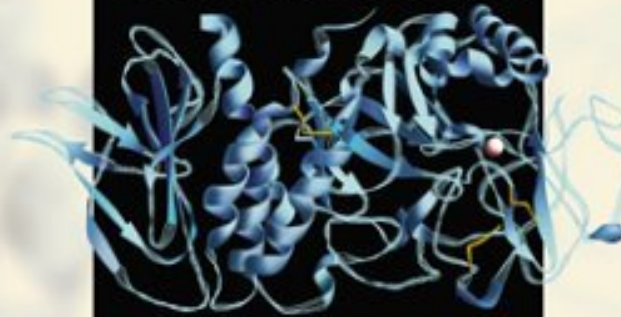
Biotechnology Laboratory



Biotechnology

DNA → Protein

A Laboratory Project



In Molecular Biology

Thiel • Bissen • Lyons

Analysis of protein structure using RasMol



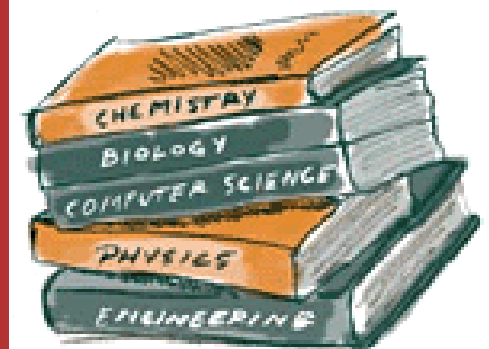
New exercises...



- DNA Sequence Search
 - GenBank
 - <http://www.ncbi.nlm.nih.gov/>
- Identification of ORF
 - ORF Finder
- Primer selection
 - Primer3
 - <http://biotools.umassmed.edu/>
- Restriction enzyme mapping
 - BLAST
 - NEB Cutter
 - <http://tools.neb.com>

Upper-level laboratories

- Molecular Biotechnology Lab
- Molecular and Cellular Biology Lab



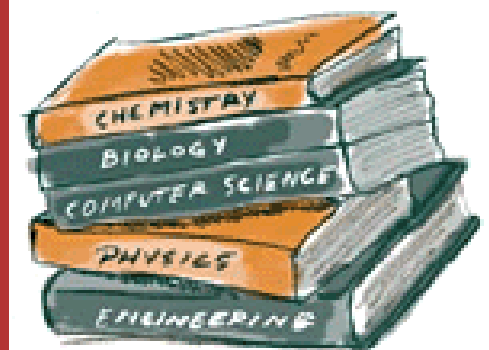
Project-based laboratory



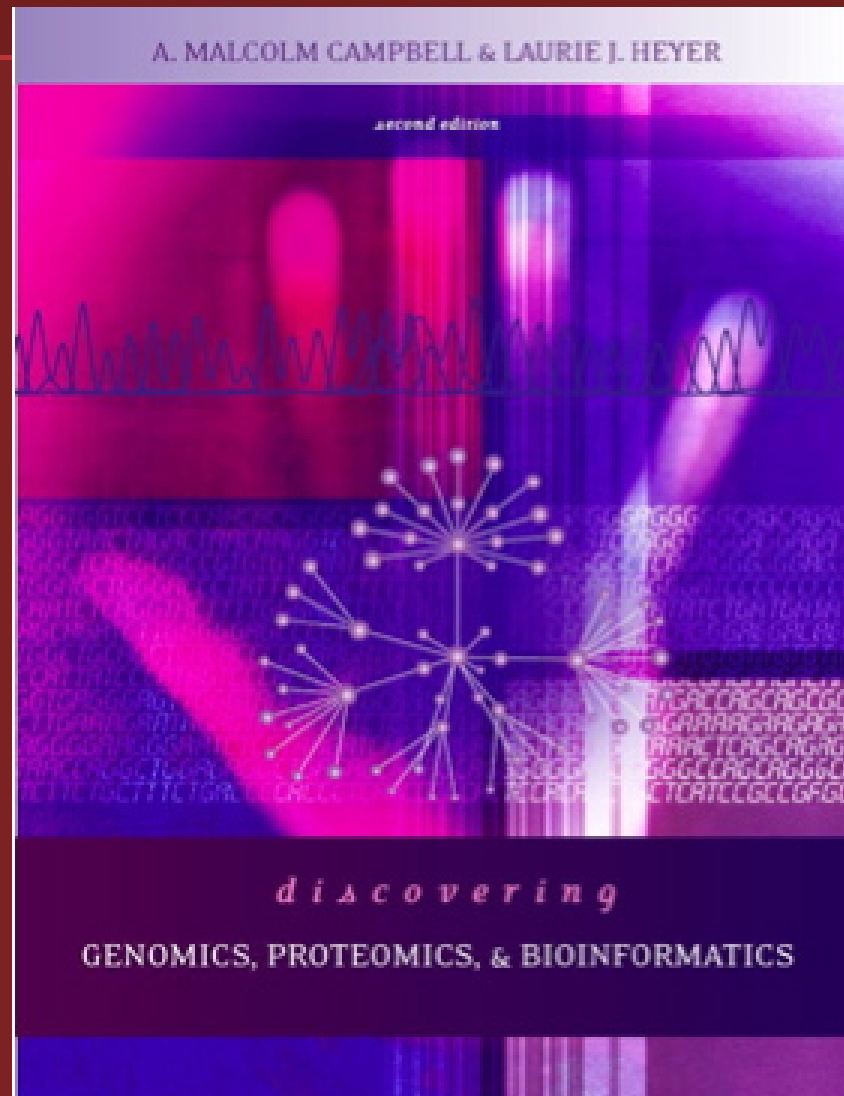
- Focus on the development of higher-order cognitive skills
- Project will study the genomics and proteomics of B cell desensitization
 - Techniques:
 - Cell culture
 - RNA isolation
 - cDNA preparation
 - Microarray hybridization and data analysis
 - Protein sample preparation
 - Immunoprecipitation
 - Western Blots

New courses

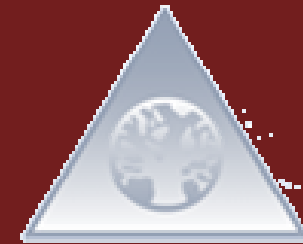
- Introduction to Molecular Bioinformatics



Biol.4360 – Spring 2007



Collaboration with NESCent



- National Evolutionary Synthesis Center
 - Education and Outreach
 - Dr. Jory Weintraub
- Videoteleconferences
 - “Introduction to Phylogenetics” - Dr. Ganesh Ganapathy
 - “Evolutionary Genomics: Natural Selection and the Human Lineage” -Dr.Todd Vision
 - “Introduction to Microarrays” – Dr. Brian Rybarczyk
 - “Introduction to Systems Biology” - Dr. Joshua Granek

	Excellent	Good	Fair	Deficient
1. Expanded your knowledge about the subject	18	2	0	0
2. Achieved the course objectives as outlined in the syllabus	16	4	0	0
3. Time distribution amongst topics	15	4	1	0
4. Establish relationships amongst other disciplines or areas in Biology	18	1	1	0
5. Fullfilled your expectations	17	1	2	0
6. Integrated and developed quantitative skills	15	4	1	0
7. Allowed you to understand current scientific topics that are pertinent to every day life	20	0	0	0
8. Improved your critical thinking skills	18	2	0	0
9. Motivate you to seek additional information about the topics covered in the course	19	1	0	0
10. Contribute to the development of writing skills	9	5	6	0
11. Contribute to the development of oral communication skills	17	3	0	0
12. Contribute to improve your computer & Internet use skills	20	0	0	0
13. Motivate you to seek information about the possibility of doing scientific research.	14	4	1	1



Final thought...

- Provide multiple strategies and approaches to facilitate student learning and skill development
 - Relevant
 - Individual



Thanks

- Dr. Rosaura Ramírez, Patricia Burrowes, Migdalisel Colón
 - Department of Biology
- Dr. Jory Weintraub, NESCENT
- Genome Consortium for Active Teaching
- “Molecules of Life”
- Faculty Resource Network

