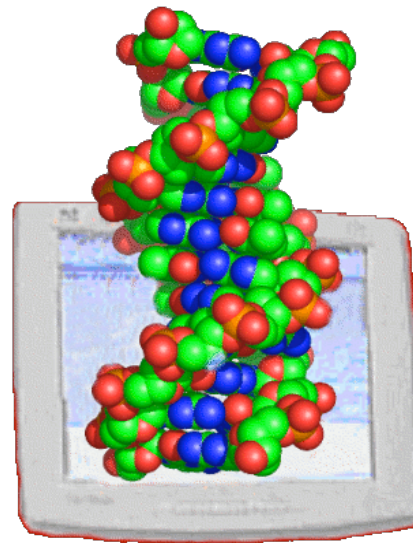




Restructuring undergraduate biology curriculum in the Post-genome era





Restructuring Undergraduate Biology Curriculum

- Breakthroughs that redirected focus of the field of Biology
- Current biology curriculum in undergraduate institutes
- Technological development and its impact on biology
- Is there a corresponding change in curriculum ?
- What is the fix?



Breakthroughs that redirected focus of the field of Biology

- Early biology was mostly descriptive
- Rediscovery of Mendel's laws by Hugo de Vries, Carl Corren and Eric Von Tschermak
 - Development of genetics
- Discovery of restriction enzymes by Daniel Nathans, Werner Arber, and Hamilton Smith
 - Biology became a manipulative science



Current Biology curriculum in undergraduate institutes

- INTRODUCTION TO BIOLOGICAL SCIENCES I (5 cr) P: Math Level 4 X 2
- MOLECULAR BIOLOGY (3cr)
- INTRODUCTION TO THE ANIMAL KINGDOM (5cr.)
- MARINE BIOLOGY (3cr.)
- ORGANISMAL PHYSIOLOGY (5cr.)
- GENETICS (3cr.)
- CELL BIOLOGY (3 cr)
- DEVELOPMENTAL BIOLOGY (3cr.)
- EVOLUTION (3cr.)
- GENETICS LABORATORY (3cr.)
- MOLECULAR BIOLOGY LABORATORY (3cr.)
- TROPICAL MARINE BIOLOGY FIELD STUDY (3 cr)
- ENTOMOLOGY (3cr.)
- ENTOMOLOGY LABORATORY (3 cr)
- BIOLOGY SEMINAR (1 cr.)



Current Biology curriculum in undergraduate institutes

- VIROLOGY (3 cr)
 - ETHOLOGY (3cr.)
 - HUMAN TISSUE BIOLOGY (4-5 cr.)
 - ECOLOGY (3cr.)
 - ECOLOGY LABORATORY (2 cr.)
 - INDIVIDUAL STUDY (Cr. arr., 6cr. max)
 - MICROBIOLOGY (3cr)
 - MICROBIOLOGY LABORATORY (2cr)
 - HUMAN ANATOMY AND PHYSIOLOGY I (5cr.)
 - HUMAN ANATOMY AND PHYSIOLOGY II (5cr.)

 - BIostatistics (Using R)(3 Cr.)
 - BIOINFORMATICS (3 cr)
- } **Newly introduced courses**



Technological development and its impact on biology

- Technological developments has enabled production of biological data at an unprecedented rate.
 - Next generation sequencing
 - Microarray data
- Remark by Francis Collins “It took 4 years to obtain the first billion and 4 months to get the second billion”
- \$1000 Genome
- 1000 Genomes project to capture human diversity
- This is only going to increase in the future.
- Biology has become a data driven science.



Change in undergraduate biology curriculum

- While all these technological developments have been happening is there a corresponding change to reflect them in undergraduate curriculum?
- New generation of biologists will be at a serious handicap if they do not equip themselves with new skills to understand and interpret data generated by the next generation technologies.
- Next generation sequencing technology is bound to make its way into medicine
- Given the above scenario, do we see incorporation of new topics in undergraduate curriculum?
- Campbell and Reece, the classic biology text has only few pages devoted to bioinformatics.



Change in undergraduate biology curriculum

- Not only is there a lag in incorporation of bioinformatics related topics in main stream biology texts, but there is also a lack of awareness of the field among freshmen undergraduates
- Classes get cancelled due to lack of awareness
- Once the student takes one course it is easier to recruit the student for an advanced course.



What is the fix?

- Bioinformatics should be viewed as Genetics's Swiss Army Knife having blades with unique function in the fields of

- Basic sciences
- Forensic Sciences
- Agriculture
- Medicine
- Pharma/Biotechnology
- Environmental science



- This message should be emphasized in all biology courses
- Make a programming course as a required computer literacy course for biology majors
- Encourage biology students to take more statistics and math courses



Questions from the Recomb Bioinformation Education Conference

- Should life sciences undergraduate be required to learn bioinformatics?
- In view of the next-generation sequencing revolution and fast proliferation of the personal genomics, should all medical students take a bioinformatics course?
- What are the topics that are appropriate to be introduced at undergraduate levels?
 - Most of us are passionate about the field and sometime tend to introduce advanced topics prematurely (I am guilty of it too!!)