

Using laboratory investigations of controversial topics to improve student learning and attitudes

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Biology 151 The old DNA lab



- Isolation of DNA from onion
- Characterization of DNA

Learning and interest

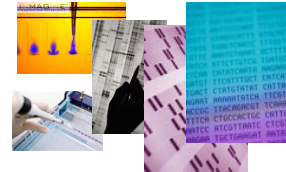


Good

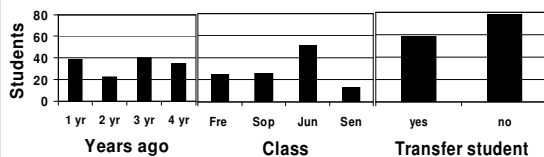


Not good!

Experiences vs Expectations



Our Biology 151 students



CA content-standard checklist for high school biology students

- B.5.c Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.
- B.5.d Students know how basic DNA technology (restriction enzyme digestion, gel electrophoresis, ligation, transformation) is used to construct recombinant DNA molecules.
- B.8.f Students know how to use comparative embryology, DNA or protein sequence comparisons, and other independent sources of data to create a branching diagram (cladogram) that shows probable evolutionary relationships.
- B.8.g Students know how several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help estimate how long ago various groups of organisms diverged evolutionarily from one another.

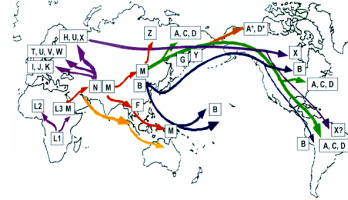
New DNA lab objectives

- Continue DNA isolation skills
- Provide opportunity for investigation
- Engage every student



Intriguing investigative opportunity

- GMO detection
- Human mitochondrial DNA sequence comparisons



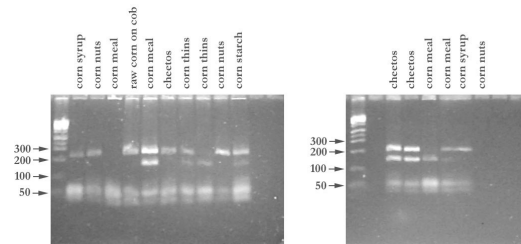
Detection of GM corn

- Every student
 - Isolation
 - PCR amplification
 - Electrophoresis



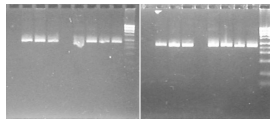
- Analysis

Analysis of corn products



Human mtDNA sequencing

- Isolation
- PCR Amplification
- Electrophoresis



- Sequencing
- Analysis

www.bioservers.org/bioserver

EDUCATIONAL WORKSPACES ONLINE

Custom Workspaces and Educational Databases for Bioinformatics

This site contains user-friendly tools to search DNA database searches, statistical analysis, and population modeling from a central workspace. Educational databases support investigations of an Alu insertion polymorphism on human chromosome 16 and single nucleotide polymorphisms (SNPs) in the human mitochondrial control region. This site requires Java, Javascript, and cookies - [click here](#) to test that you have these features enabled.

SEQUENCE SERVER
Enter DNA sequences, perform multiple sequence alignments, BLAST to BLAST a set of targets, transfer coordinates between data sets, and population of a new set of other sequences - human, and other organisms.

ALLELE SERVER
Enter data on Alu SNPs, hair typing, forensic identification, and compare polymorphisms, genetic path, and family structure. Includes DNA microarray data from one class to build population.

SIMULATIONS SERVER
Model genetic changes over time to show the effect of drift, selection, mutation, and migration. Simulations are saved in our database between sessions. This can also save your own custom databases, according to your own interests.

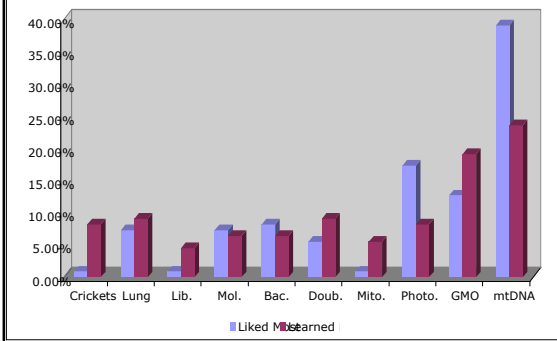
ENTER
No login feature available.

REGISTER
ENTER: You have access to all tools and databases, but your work is not saved between sessions.

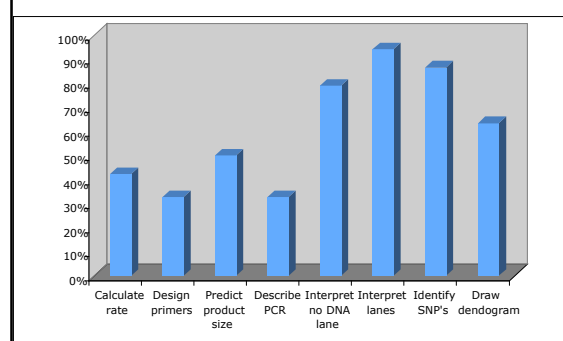
REGISTER & LOGIN: Then, when you login with username and password, your settings and notifications are saved in our database between sessions. This can also save your own custom databases, according to your own interests.

LOGIN

Student Positive Opinions



Exam Results



Lessons Learned

- If they don't do it, they won't learn it
- The more it's about them they better they learn
- They like high tech
- Controversial topics didn't seem to matter

Cost

- | | |
|---|---|
| <ul style="list-style-type: none"> • GMO <ul style="list-style-type: none"> – Primers, agarose \$80 – Extraction & amplification \$1.70 / student | <ul style="list-style-type: none"> • Human mtDNA <ul style="list-style-type: none"> – Primers, agarose, chemicals \$230 – Tubes, amplification \$2.40 / student – Sequencing service \$12.75 / student |
|---|---|