

Case It: integrating molecular biology computer simulations and bioinformatics into case-based learning and student research

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The screenshot shows a virtual laboratory interface with a menu bar at the top containing 'Quit', 'Notes', and 'Tutorial'. The main workspace is divided into three horizontal sections. The top section features a 'Heat block' on the left, a pipette on the right, and a rack of test tubes in the center. The middle section contains a biohazard container on the left, a central text box with the title 'Case It! 6.06' and a list of activities, and a rack of microarrays on the right. The bottom section shows an electrophoresis power supply on the left, an electrophoresis tank in the center, and the 'MADE WITH macromedia' logo on the right.

Quit Notes Tutorial

Heat block

Case It! 6.06

- DNA / protein electrophoresis
- Restriction digests / mapping
- Southern / Western / Dot blots
- Multiplex PCR and ELISA
- Bioinformatics analyses
- DNA chips (microarrays)

Click here to begin...

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1 2 3 4 5 6 7 8
MADE WITH macromedia™

Introductory Biology Project Conference, AAAS Headquarters, 2012

Overview

- Introduction to *Case It!* project
- Use of *Case It!* in introductory biology courses
 - Genetic disease cases with role playing
Huntington's disease example
 - HIV cases with introduction to bioinformatics
 - Open-ended research applications
HHMI SEA-PHAGES project
 - New – microarray cases (SNP and expression)

Case It! Project

URL for Case It! Home Page:

<http://www.caseitproject.org>

- Includes tutorials and download links
- Access to cases descriptions

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Case It! Project

Electronic framework for analyzing and discussing case studies in molecular biology

- Genetic and infectious diseases and associated ethical issues
- Students gather background information on cases
- Analyze DNA and/or protein sequences using Case It! simulation
- Online poster sessions
- Role-playing

Techniques for DNA and protein analysis

Case It! simulation

Features of Case It! simulation

- DNA and protein electrophoresis
 - Restriction enzyme digestion and mapping
 - Southern blotting
 - Dot blotting
 - Polymerase Chain Reaction (single and multiplex)
 - ELISA
 - Western blotting
 - Microarrays (SNP and expression)
- Case studies in genetic and infectious diseases and other biology topics

Case It! Simulation

New features in version 6.06

- Bioinformatics tools
 - » Open and save FASTA sequences
 - » Connection to BLAST and other NCBI tools
 - » Integration with MEGA software
 - Alignments
 - Tree building
 - » Other
- Microarray simulation
 - » SNP
 - » Expression

Huntingon's disease case

Case scenario - from Case It web site

Restriction enzyme digestion and Southern blot
or

PCR and gel electrophoresis

Sequence analysis - detect triplet base repeat,
sequence alignment and BLAST to identify
gene

Role playing

- Students present the results of their case analysis as a web poster
 - Includes a statement to the “family”
 - Wiki system provides group web posters with associated discussions

caseitconferencing.wikispaces.com
- Visit another group’s web poster and post questions in the role of a person in the case
- Authors respond to questions in the role of a genetic or health counselor

Case It! mobile

- Access to case scenarios and lab results from tablets, smart phones, and Macs
- See prototypes at www.caseitproject.org/mobile

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HIV Case studies

Case scenario - video and text (Anna case), from Case It web site

ELISA test - initial screening (new autoloader feature)

Western blot to follow up ELISA results

PCR to amplify HIV DNA for viral load or sequence analysis

Sequence analysis to determine source of HIV infection

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Open-ended research

- HHMI SEA-PHAGES project in General Biology course for freshmen
- Lab sequence replaced by phage research
 - Isolate mycobacteriophages from soil
 - Isolate phage DNA and analyze by restriction enzyme digestion
 - Select one phage to send for sequencing

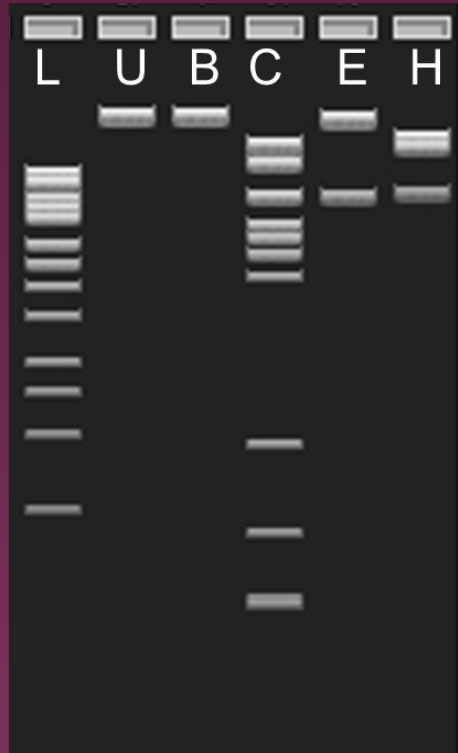
Open-ended research

- Spring semester – phage genomics
- Retrieve complete phage genome sequence
 - Annotate genes
 - Comparative genomics
 - Research projects on phage biology
- www.phagesdb.org

Abrogate lab gel



Abrogate virtual gel

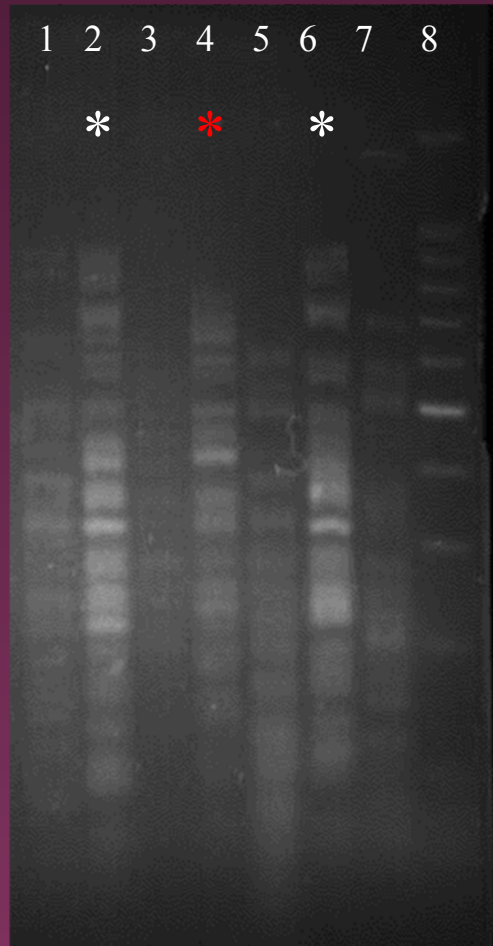


Bxb1 virtual gel

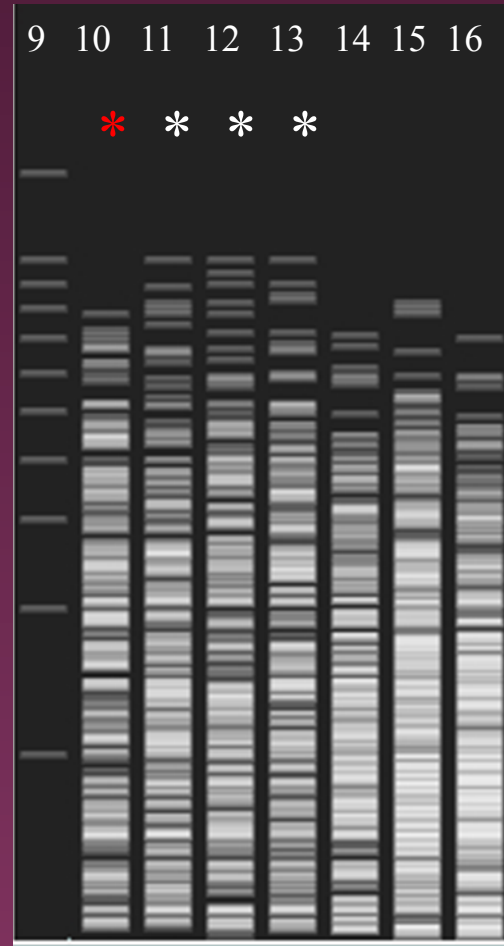


L=1 kb ladder; U=undigested; B=BamHI; C=ClaI; E=EcoRI
H=HindIII

HaeIII Lab Gels



HaeIII Virtual Gel



- Ran separate in 2% agarose gel
- * Indicates A1 phages
- * Indicates Abrogate
- Abrogate significantly different from A1 phages

Phage studies

Digest phage Abrogate with enzyme set to compare with database of known phages

Digest three phage genomes with HaeIII
--compare fragment patterns
--BLAST fragment sequence to determine genome location

Case It! Project

Additional Collaborators

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