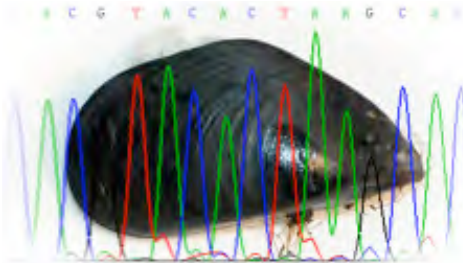


# Marine Biotechnology and Bioinformatics



A program of ITEST (Information Technology Experiences for Students and Teachers) funded by the National Science Foundation



## **Taking DNA Analysis into the Classroom**

### **DNA Fingerprinting**

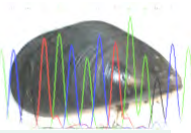
Biology

High School 9-12

Dawn R. Spencer

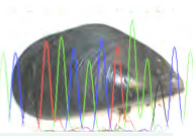
Valley Christian High School

San Jose, CA



## Background Context

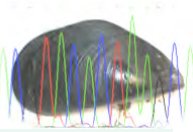
- ▶ To assess DNA fingerprints starting from DNA as extracted from individual species and run through the process using biotechnology equipment.
- ▶ Students have never used biotechnology tools before.
- ▶ I will provide instruction and examples of how to use a micro pipette and related tools in assessing DNA fingerprints.



# Instructional Goals

- ▶ Students will be able to:
  - ▶▶ Goal 1: properly assess DNA fingerprints, and
  - ▶▶ Goal 2: learn laboratory protocol for pipetting and manipulating biotechnology equipment.

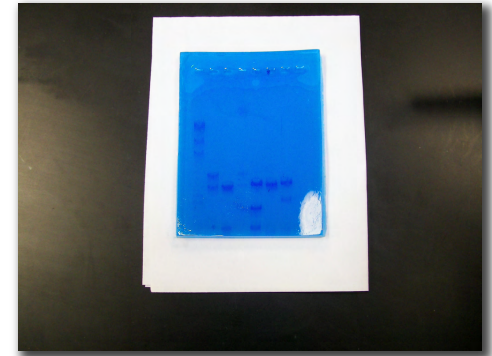




# State Standards

## ▶ Biology/Life Sciences grades 9-12

- ▶▶ Genetics: 5. a-e: The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells.
- ▶▶ Investigation & Experimentation: 1. a-d: Scientific progress is made by asking meaningful questions and conducting careful investigations.
- ▶▶ To view the entire list of California state standards click on the following links.
- ▶▶ [Biology](#) and [Investigation & Experimentation](#)



# Instructional Objectives

## Objective 1:

- ▶ Given a micropipette, students will be able to manipulate the pipette with the exact volumes of micro liters to extract 10 micro liters into a micro tube with 98% accuracy.



## Objective 2:

- ▶ Given the DNA and enzymes, the students will be able to identify how the DNA molecule creates the different bands and runs through the gel based on their size and nucleotide sequence with 95% accuracy.

# Instructional Objectives

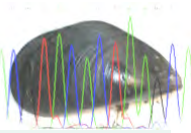
## Objective 3:

- ▶ Given 20 micro liters of DNA and staining die, the students will be able to transfer 10 micro liters into an agarose gel inside an electrophoresis chamber filled with buffer with 98% accuracy.

## Objective 4:

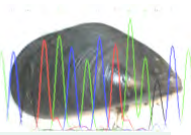
- ▶ Given the DNA fingerprint, the students will be able to decipher which suspect matched the DNA fingerprint found at the crime scene.





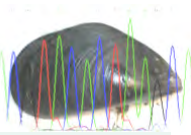
# Materials and Resources 1/2

- ▶ Micropipette
- ▶ Micro tubes
- ▶ Electrophoresis chamber
- ▶ Pipette tips
  - ▶▶ Large & small



# Materials and Resources 2/2

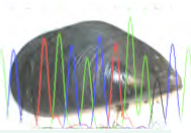
- ▶ Learning about and how to use the micropipette
  - ▶ [MicroPipet technique info sheet](#)
  - ▶ [Micropipet Reading scale](#)
- ▶ Micropipette practice Techniques
  - ▶ [Micro pipetting techniques](#)
- ▶ DNA Lab Packet Materials & Procedures
  - ▶ [materials\\_procedures cklist](#)
- ▶ DNA Fingerprinting, Quick Guide to DNA Fingerprinting and the DNA Lab Student Manual
  - ▶ [Lab DNA fingerprinting](#)



# Instructional Strategies

Strategies to implement the lesson include:

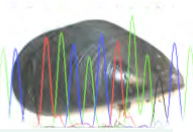
- ▶▶ Demonstration of use with a micropipette
- ▶▶ Hands on practice
- ▶▶ Ongoing teacher evaluations of student practices
- ▶▶ Gel loading
- ▶▶ DNA fingerprint assessment



# Assessment

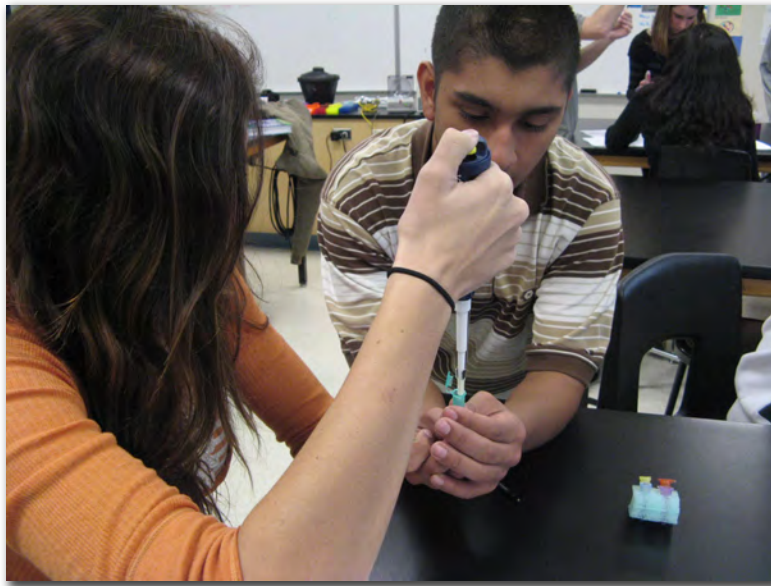
To Assess that the objectives were met;

- ▶▶ Ongoing observation of use with micropipette
- ▶▶ Accuracy of DNA samples in gels
- ▶▶ DNA banding
- ▶▶ The outcome of DNA fingerprints and their accuracy in comparing the bands.

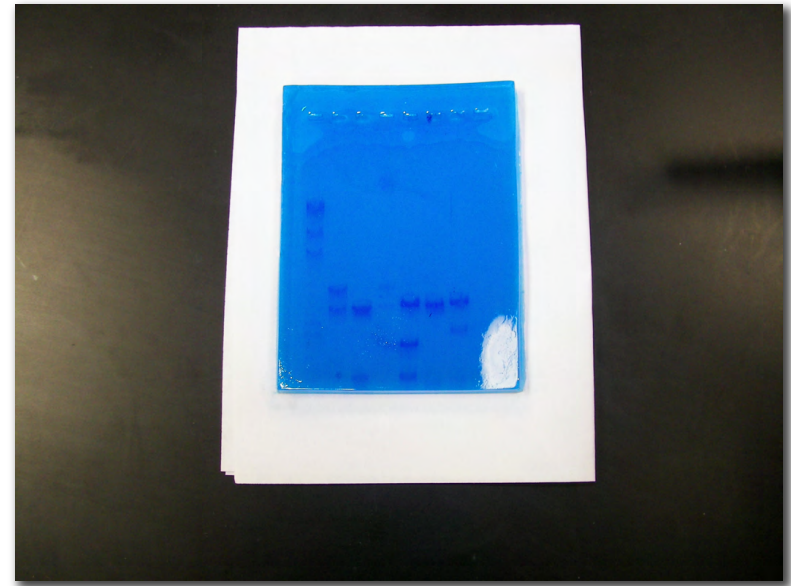


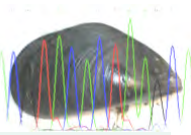
## Learning Outcomes

Results of the lesson showed a high degree of accuracy in DNA banding and student predictions.



DNA Fingerprinting

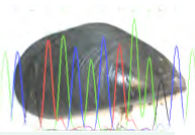




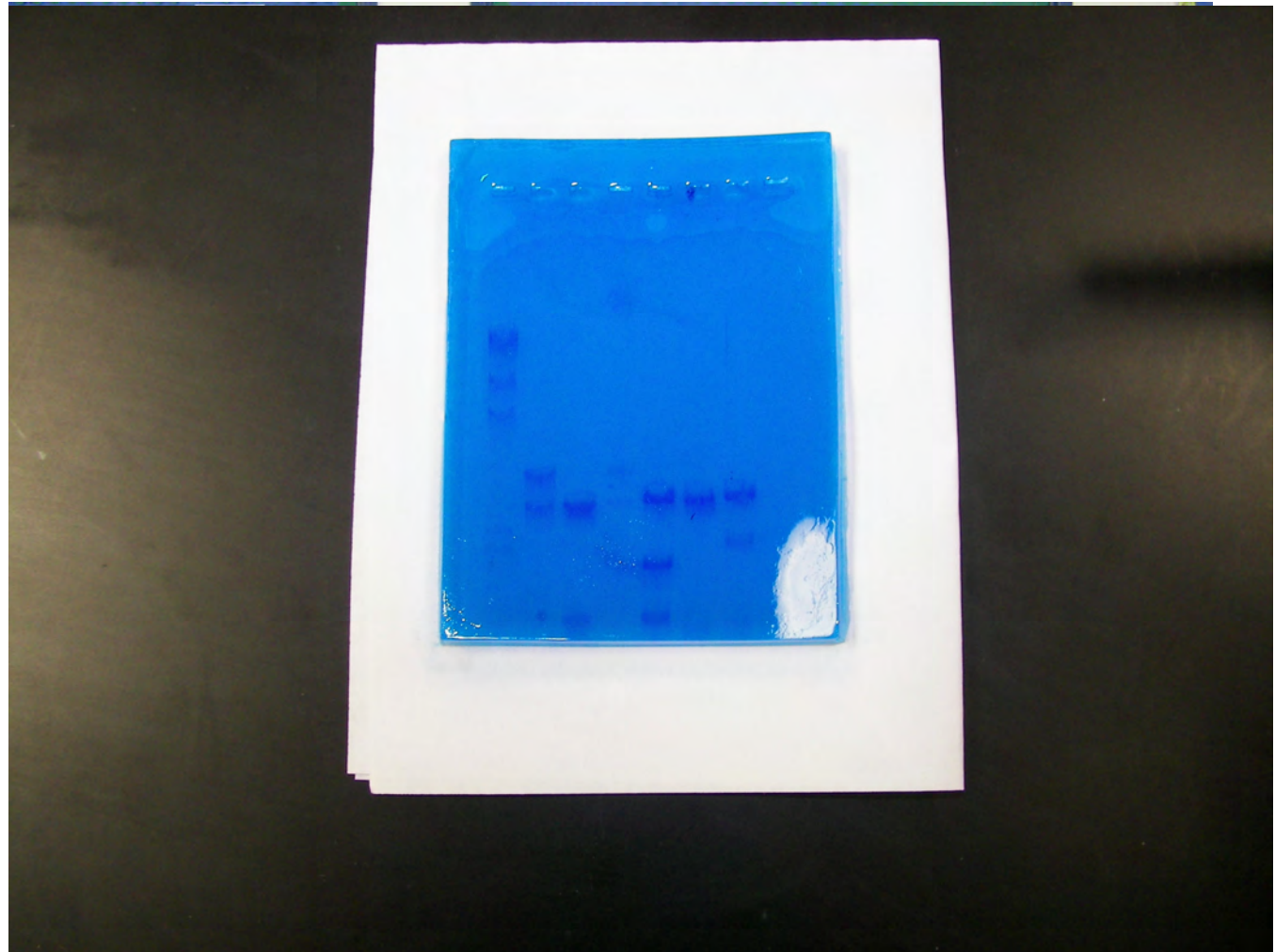
## Lessons Learned

As I look back on the lesson, the outcome of the students work was high and the kids came into the room looking forward to their day.

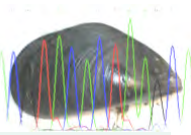
- ▶▶ smiles, enthusiasm in what they were doing, anticipating the outcome, and overall success in reading the DNA bands.



# DNA fingerprinting

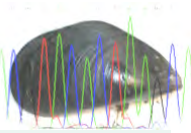


DNA Fingerprinting



## Lessons Learned

- ▶ The things that worked well include:
  - ▶▶ The first lesson of manipulating the micropipettes
  - ▶▶ The practice loading sessions
  - ▶▶ The DNA banding
- ▶ Improvement could be noted in
  - ▶▶ The timing of running the DNA through the electrophoresis chamber.



## Contact

- ▶ For more information about this lesson, contact:
  - ▶▶ Dawn Spencer
  - ▶▶ Biology teacher, 9-12
  - ▶▶ Valley Christian High School,
  - ▶▶ San Jose, CA
  - ▶▶ [dspencer@valleychristian.net](mailto:dspencer@valleychristian.net)