JENNIFER L. DUNCAN-TAYLOR

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18 years teaching high school, all in Port Angeles. 1,500 students at PAHS

Currently teaching four sections of Sophomore General Biology and one section of Advanced Placement Biology.

SEP participant in 1996.

Member of the SEP Elephant Project Curriculum Development Team for 2000-'02

With my high school science department colleagues, we have developed a curriculum that integrates 9-12 physical science, biology and chemistry and AP biology. It features principles of electricity, hydrolysis, ionization of molecules, pH, buffers, properties of matter and separation techniques. Electrophoresis features all of these principles, and students apply this technology in their sophomore year to separate DNA, their junior year to study molecules by doing SEP's Dye Lab, and their senior year in the High School Human Genome Project.

Outside of the classroom, I enjoy puttering in my pottery studio, painting, downhill skiing, sailing our boat and catching Dungeness crab. My husband and I also own and operate a lavender farm and gift shop in Sequim.

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PORT ANGELES HIGH SCHOOL
JENNIFER L. DUNCAN-TAYLOR

- 4 sections of Sophomore General Biology periods 1, 2, 5, 6
- 55 minute class periods
- 30-32 students per class
- 8 lab groups of 3 or 4 students

Before beginning the Elephant Project, students have completed DNA structure, replication, protein synthesis, genetics and have islolated DNA from plant tissue.
I use this project as a springboard to population genetics, changes in populations and ecology.

HOW I CUSTOMIZE THE ELEPHANT PROJECT FOR MY CLASSES:

Monday 55 min: Introduce the goals of the project, give info about Dr Comstock and Wasser and give students the Websearch assignment (which students have to do at home or in the library on their own). I give a brief discussion on restriction enzymes, palindromes and cutting DNA into pieces. The last 15 minutes of class we start the paper RFLP activity by cutting up elephant paragraphs—I draw the analogy that this is like isolating DNA into one big glob.

Tuesday 55 min: Students bring in their long strips of paper-DNA-elephant paragraphs and we do the RFLP activity. Much discussion—and I give them the assessment to do as homework.

After school, I arrange the room into 8 lab stations and prepare a color-coded lab tub for each station so I can refer to the "green group" "purple group" and so on. Every piece of equipment is also color coded for the lab station. Each tub includes: a micropipet, box of tips, microtube holder, ice cup, sharpie marking pen, waste-tip cup,

Wednesday 40 min: Learn how to use a micropipet and start the SEP activity with the food coloring on round filter papers. We only get through the placement of 3ul of each red, green, yellow and blue dots on the filter paper.

Thursday 55 min: Continue working with micropipets, and learn how to use the microcentrifuge by completing their four mixed colors and finishing their 3 ul dots on the filter paper. Also, I have poured "practice gels" with the combs in petri dishes, and I prepare a faux-loading buffer with blue food color and karo syrup and water. When students have finished their filter paper dots, then the flood the practice gel with water and practice how to load a sample in to the gel.

Friday 55 min: I demo the electrophoresis chamber and discuss charge, voltage, polarity, hydrolysis, pH, buffers. I use distilled water and start the power, then add a little salt water and start the power. Then I add phenol red for a pH indicator and run it for a few minutes (beautiful yellow and hot pink at the + and – poles respectively!) We talk about the dynamics of H+ and OH- ions, hydrolysis and pH. Then I pour in some TAE buffer and watch how the pH remains stable. I talk about the need to hold pH stable for the sake of DNA, and yet still be able to maintain charge to move the DNA.

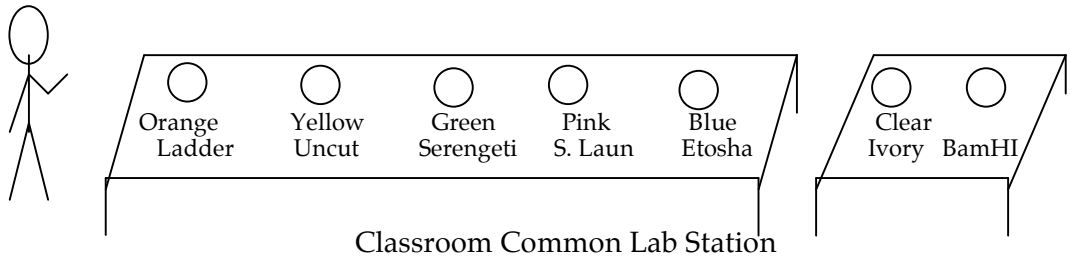
I allow time for students to get into groups and discuss how the web searches are going, share information and begin to talk about what the issues are about ivory trade.

Finally, students are given the protocol to the lab (see my "quick guide") and asked to draw a flow chart over the weekend.

On Friday after school: I remove the FHCRC DNA samples from the freezer and thaw them for just a few minutes and aliquot the samples into "class sets" as follows—then return them BACK TO THE FREEZER for Monday.

30ul of each precut sample, ladder and uncut DNA for each class (each lab group needs 3ul, assuming you will have 8 lab groups, you need 24ul, and I recommend 30ul for each class). **NOTE:** You will need 32ul of "ivory" DNA for each class, and I recommend that you aliquot 40ul for each class since each lab group will need 4ul. I aliquot 15ul of REact Buffer in a single microtube for each class, and 12ul of BamHI enzyme for each class.

I set up a Common Lab Station by placing 7 bowls marked with the corresponding DNA sample (the DNA needs to be kept on ice throughout the class period). I also recommend using colored microtubes, using a different color for each national park. Students should have microtubes that correspond in color. For example:



Classroom Common Lab Station

Mark the aliquot samples as follows: "LADDER" (marker), "UNCUT DNA", DNA Sample I should be labeled the "SERENGETI", DNA Sample II should be labeled SOUTH LUANGWA, and DNA Sample III should be labeled "ETOSHA".

I prepare zip-lock baggies with microtubes of the 5 colors for each lab group (32 in all—8 groups per class, 4 classes).

Monday #2 55 min: LAB! I get a bucket of crushed ice and put the class set of tubes (that I did last Friday night) at the common lab stations. Each group will need a cup of ice as well. I lead a brief review about cutting DNA with enzymes, check their flow diagrams, and review the procedures with the entire class. At the end of class, we have "ivory" tubes in the incubator, and the rest are in the freezer. I put the "ivory" tubes in the freezer after an hour.

After school on Monday, I put an electrophoresis gel chamber and a vial of loading buffer at each lab station. I also prepare the running buffer solution.

Tuesday #2 55 min: Before school, I premix and heat agarose gel and hold it in a water bath. Periods 1 and 5 will pour their gels, thaw out their DNA samples, add loading buffer and spin, prepare their gel boxes with running buffer, load their DNA samples and start the power.

Periods 2 and 6 watch the Discovery Channel Elephant Film.

I stop the gels, slide them out into staining trays, stain and destain them. Then I put them in zip-lock baggies for tomorrow.

Wednesday #2 40 min: Periods 1 and 5 look at their gels, take measurements and fill in their data table.

Periods 2 and 6 pour gels, thaw out their DNA, add loading buffer and spin, prepare their gel boxes with running buffer, load their DNA samples and start power. Again, I stop the gels and do the staining for them.

Thursday #2 55 min: Periods 1 and 5 do their semi-log graph and begin to make comparisons between Comstock data and their data and look for possible matches with the ivory.

Periods 2 and 6 look at their gels, take measurements and fill in their data table.

Friday #2 55 min: Periods 1 and 5 watch the Elephant Video that the other classes saw on Tuesday.

Periods 2 and 6 do their semi-log graph and begin to make comparisons of Comstock data, their data and their ivory.

On Friday after school—I clean up, do kit inventory and return the kit to SEP on Saturday.

Monday #3 55 min: All classes continue their analysis of the data, look at maps share internet information and work on their Concept Questions. I also have the students do a formal lab write-up and do the "Submission Form." We wrap up with a discussion about laws, exporting and whether or not Grandma and Grandpa are in trouble legally.

As of yet, I have not fit it the ethical dilemma activities, but I do use the final assessment using DNA to identify Whales or Lynx. Other places I have assessed students in this project were their micropipetting skills, lab flow chart and formal lab write up.

Elephant DNA & Ivory Analysis Lab Protocol—Quick Guide

	First Day of Lab	Second Day of Lab
Student #1	Label all tubes: period and group color Pipet 10.5ul of sterile H2O into each tube, EXCEPT put only 8.5ul into the white "ivory" tube. **No need to change tips each time.	Get the gel box, comb and set it up with the rubber gaskets sealed. Pour the warm gel so that it comes us 1/3 up the teeth of the comb. When the gel is ready and your partners have finished preparing the samples, you will load 15 ul of LADDER and the UNCUT samples in to the gel.
Student #2	After student #1 has finished, bring all tubes to the Common Lab Station, keep them on ice. Use the ultra-micropipet and tiny tips to add 1.5ul React Buffer to all six tubes. **No need to change the tip each time.	Work with student #1 to prepare gel. After gel is set, lift out tray and rotate it so the comb is on the negative (black) end. Pour 600+ml running buffer into chamber and make sure all "gel peaks" are submerged. When students #3 &#4 have the samples ready, you will load 15ul of SERENGETI and S. LUANGWA samples in to the gel.
Student #3	After student #2 has finished, bring all tubes, your yellow tips and your p2/20 micropipet to the Common Lab Station. Keep tubes iced. Add 3ul of DNA from the assigned source into each of the tubes. KEEP THEM STRAIGHT!! Add 4ul of the ivory DNA to the white tube. **CHANGE TIPS EACH TIME.	While students #1 & #2 are preparing the gel, get your groups tubes out of the freezer and let them thaw. Add 3ul of Loading Buffer in to each tube. **CHANGE THE TIP EACH TIME. After your partners have loaded the samples, you will hook up the power, clean up and inventory your groups tub supplies. Throw out all tips and used tubes.
Student #4	Help student #3 load DNA samples. Close all tubes except the "ivory" and use the ultramicropipet and tiny tips to add 1ul of BamHI enzyme to just the "ivory" sample. Close the top, centrifuge all six tubes. Put the "ivory" tube in the incubator, and the rest in the freezer.	While students #1&#2 are making the gel, and student #3 is preparing the sample: prepare a sketch "plan" of which order the samples will be loaded into the gel.After student #3 has added loading buffer, will mix them in the centrifuge for 10 sec. You will loat 15 ul of ETOSHA and the IVORY samples into the gel.

NOTE: For one class period we were cramped for time because of a pep assembly—I poured the gels and added running buffer for them before they came in to class, so that all they had to do was add loading buffer, spin and load samples into the gel.