FRED HUTCHINSON CANCER RESEARCH CENTER
SCIENCE EDUCATION PARTNERSHIP

DNA Labs 1 & 2
Tips for Teachers

Regardless of the length of your class periods, there are several ways to manage and optimize these gel electrophoresis labs for your classroom use. We encourage you to map out a schedule of approximate times for each step so that you and your students may enjoy the lab experience. These time approximations are based on how long a student would take; assuming it is the first time a student has performed these labs. Times may be less if your students have more experience with these labs. Use these tips as a way to optimize and adapt these labs for your use over a period of days.

Gel preparation

Time approximation: 30 minutes. This includes weighing, measuring, melting, staining, pouring, and setting agarose.

√Tips

- Have a few students prepare and pour gels for the class. Do this ahead of the gel loading and running day and have students carefully store gels in a small volume of buffer in Ziploc® bags and keep in the refrigerator until needed. Meanwhile, have the rest of the class flowchart for the gel loading lab day. For the next lab, have different students make and pour gels for the class.

- You or your TA can make all of the agarose gel solution ahead of time and keep liquefied in a 60°C water bath until the students are ready to pour.

Sample preparation for precut DNA Lab 1

Time approximation: 25 minutes

√Tip

- Make samples and store in the refrigerator or freezer until ready to perform the gel loading and running steps.

Sample preparation for the restriction digest of DNA Lab 2

Time approximation: 25 minutes for sample preparation and 60 minutes for the digest.

√Tip

- Incubate digests overnight or throughout the class day. Spin down and freeze digests until ready to perform the gel loading and running steps.

Gel loading, running, staining and destaining

Time approximation: 20 minutes for loading, 45 minutes for running and 40 minutes for staining.

*Note-In order to obtain the optimal results for these DNA labs, the run time of 45 minutes at 100V is highly recommended. Any variation of these parameters will affect the results**.** *

√Tips

- Have students run the gels until the DNA samples have entered the gel—about 10 minutes—then stop the run, carefully remove the gel and store in the refrigerator, in a Ziploc® in a small amount of buffer until the next day.

- Have students run gels for a shorter time, e.g. 30 minutes. Any less than that will result in poor band separation.

- Make the running buffer at 0.25X TAE. Use this concentration when you make the gels and the running buffer. You can then crank up the voltage up to 200V and run for 20 minutes and achieve decent band separation. (And the gels will stay intact.) The only problem with short runs at high voltage is poor separation of large pieces of DNA. For example, DNA Lab 2 and the Elephant Project use a BamHI digest, which has several large fragments. In higher voltage and shorter runs, these bands don't separate well rendering three pieces instead of five.

- Shorten active destaining time. Perform the staining (15 minutes) and then destain twice with distilled water and then leave in tray and destain overnight in a small volume of distilled water. Cover tray with plastic wrap, label, and store in the refrigerator until the next day.

Gel band tracing

Time approximation-10-20 minutes per gel, depending on visibility of bands.

√Tips

- Model this activity by having a gel on the overhead so that students know what they are tracing. Show students that they need to trace the wells and any band they see.

- Have one or two students from each group trace the bands and then have other students trace the trace. Wrap gels in plastic wrap, label, and store in refrigerator for future reference.

Gel band measuring (for semi-log plotting activity)

Time approximation 30 minutes, depending on visibility of bands traced.

√Tips

- Model this activity by making a table on an overhead for students to see. Show students how to measure bands for each lane by using gel drawing from tracing activity. Show students how to measure from bottom edge of well to bottom edge of band.

- Explain that students will need to measure each lane of data, and each band in each lane. These data can then be entered in a data table as lane, band number, and distance traveled in mm. See s**ample** below. Have students make the number or rows in their table based on the lane with the greatest amount of bands. A data table will expedite the semi-log graphing process, should you choose to perform this step.

Sample table for entering data:

Lane 1		Lane 2		Lane 3		Lane 4		Lane 5	
DNA band size in bp	Distance traveled in mm	DNA band size in bp	Distance traveled in mm	DNA band size in bp	Distance traveled in mm	DNA band size in bp	Distance traveled in mm	DNA band size in bp	Distance traveled in mm

General Tips

We advise that you map out these labs and plan for stopping points that would work in your situation. Try to eliminate bottlenecks by setting up stations and/or assigning experts to perform certain tasks. Aliquot solutions and reagents for the number of groups working, and set up stations so that there is easy access to reagents.

If you are using any of these suggestions, make sure your students label their gel containers (either trays or Ziploc® bags) with label tape provided in the kit. This will help students identify their gels easily—especially if one class is helping another.

In some classrooms, teachers have classes work together to help the previous class or the next class. For example, on one day the earlier class can make and pour the gels and the next class can load and run their own samples in these gels. On a different day, the later class can make and pour the gels for the earlier class. This option can be used for gel running too. One class loads and runs, the other class stops the run and stains and destains. Depending on your school's class schedule, these might be creative options for you.

Please call us if you have any questions, concerns or suggestions about running these labs smoothly. We value your input as it helps us improve these protocols for all SEP teachers.