Biotechnology: Restriction Enzyme Analysis of DNA

How can we use genetic information to identify and profile individuals?

Name: _____ Date: _____ Class/period: _____

Dataset ID: _____

https://biologylabbench.com/lab09

How to use this guide

Check off each numbered step as you work in the online simulation. Follow your teacher's assigned sections and repeat counts. This guide explains the workflow; enter your measurements and responses in the lab or your assigned worksheet.

Use Data for tables and editable calculations, Graph for plots, and Scene for the simulation. Some controls are under More options. Write predictions before running an experiment and scroll below the simulation for response boxes.

Overview

- ☐ 1. Read the driving question and your teacher's assignment. Note which sections, optional extensions, and number of trials your teacher wants you to complete.
- ☐ 2. Sign in with your name and class period. Copy your Dataset ID onto this guide. Keep using the same dataset for the investigation; classmates may have different numbers.

Background

- ☐ 1. Read the background explanations, diagrams, and vocabulary. Review the reference formulas you will need and identify the variables you will measure.

Pre-lab

- ☐ 1. Complete the pre-lab questions and any practice activities. Use Check answer, read the feedback, and revise your reasoning before starting the investigation.

Restriction enzymes

- ☐ 1. Inspect the template strand and predict the number of fragments before digesting it. Choose the enzyme, run the digest, and compare fragment ends and sizes.
- ☐ 2. Use the λ restriction map to test enzyme combinations. Record the selected enzymes, cut sites, and fragment lengths; check that lengths sum to the starting molecule's length.

Run a gel

- ☐ 1. Select a sample tube and an empty well to load it. Repeat for the required samples, including the HindIII marker and uncut λ control; record the lane order and loading conditions.
- ☐ 2. Connect the leads as shown, set the gel percentage and voltage, and Power on. Watch the dye front; stop with about 1 cm remaining before the end of the gel.
- ☐ 3. Stain, then destain the gel. Wait for each stage or use Skip ahead. Record observations of the visible bands before measuring.

Standard curve

- ☐ 1. Measure each visible band or use Measure all visible bands for each lane. For the marker lane, enter the supplied known sizes in the correct band order; use the reference on the page rather than calculating the known sizes.
- ☐ 2. Keep the >20,000-bp doublet exclusion enabled for the standard fit unless your teacher directs otherwise. Check $\log_{10}$(bp) versus distance, its equation, and R^2.
- ☐ 3. Read unknown-band estimates from this fit. Label estimates beyond the fitted marker-distance range as extrapolations; discuss why they are unreliable. Repeat measurements or gels if assigned and report uncertainty.

Design: crime scene

- [ ] 1. Enter the case number assigned by your teacher; do not assume the personal default is the assigned case. Write your question, prediction, and plan.
- [ ] 2. Load the marker, blood, and suspect samples. Run, stop, stain, destain, and measure the gel using the same procedure as the practice gel; enter known marker sizes.
- [ ] 3. Choose and justify a matching tolerance based on measurement variation. Compare corresponding fragment estimates, including missing or extra bands, and state which profiles are consistent with the evidence and what the evidence cannot establish.

Analyze

- [ ] 1. Answer every assigned analysis question using your own recorded data. Include numbers, units, and comparisons from the appropriate Data and Graph panels.
- [ ] 2. Complete the requested calculations or statistical comparisons. Show your method and explain what the result means biologically. Write the claim, evidence, and reasoning response if shown.

Evaluate

- [ ] 1. Compare your original predictions with your results. Explain any disagreement, limitations of the simulation, and one way to improve the investigation.
- [ ] 2. Complete the assigned reflection/evaluation questions and AP-style response if shown. Use your own data where requested. Rate your confidence if you wish; ask your teacher about any unfinished or unclear work.

Submit

- [ ] 1. Review the completion checklist and Preview my report. Check your name, period, Dataset ID, calculations, units, graphs, and written responses.
- [ ] 2. Download .docx or use Save as PDF as directed by your teacher. Open the downloaded file and check that it contains your work, then upload or hand it in where your teacher specifies. Downloading alone does not submit it.
- [ ] 3. Save a progress file using Move your work to another computer if you need a backup or will change devices. Keep recordings separately if assigned; a report cannot restore editable progress.

Teacher instructions / notes