



Modeling DNA Fingerprinting with Markers and Food Coloring



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Objectives

Upon completion of this lab activity, students should be able to:

1. Describe how gel electrophoresis separates pieces of DNA by size.
2. Use gel electrophoresis to determine paternity.

Benefits

- Cheap!
- Non-toxic
- Can be stored at room temperature for at least 1 year
- Produces reliable results

Scenario

A couple is going through a divorce. Brad claims that his wife Angelina has been unfaithful to him. He believes that she has been having an affair with another man (Leonardo). You have been provided with DNA samples from Brad, Angelina, Leonardo, his wife Jennifer, and four children. These samples have already been digested with restriction enzymes and are ready to be run on your agarose gel. Your job is to determine who the parents are of each of the four children and whether Angelina did in fact cheat on Brad.

Procedures

Crayola Markers and High-lighter

1. Remove base of marker and squeeze out marker dye.
2. Dilute : 90uL dye + 900uL of dH2O + 350uL 60% sucrose

Red, Orange, Blue, Purple, Pink, Black
Yellow high-lighter



Spectrum Deep Pink Food Coloring

3. Dilute Spectrum food color: approx. 100uL food color (about 1 drop) + 1000uL dH2O

Brad: Deep Pink FC, Pink CM, Red CM

Angelina: Blue CM, Orange CM, yellow hi-lighter

Leonardo: Purple CM, Pink CM

Jennifer: Black CM

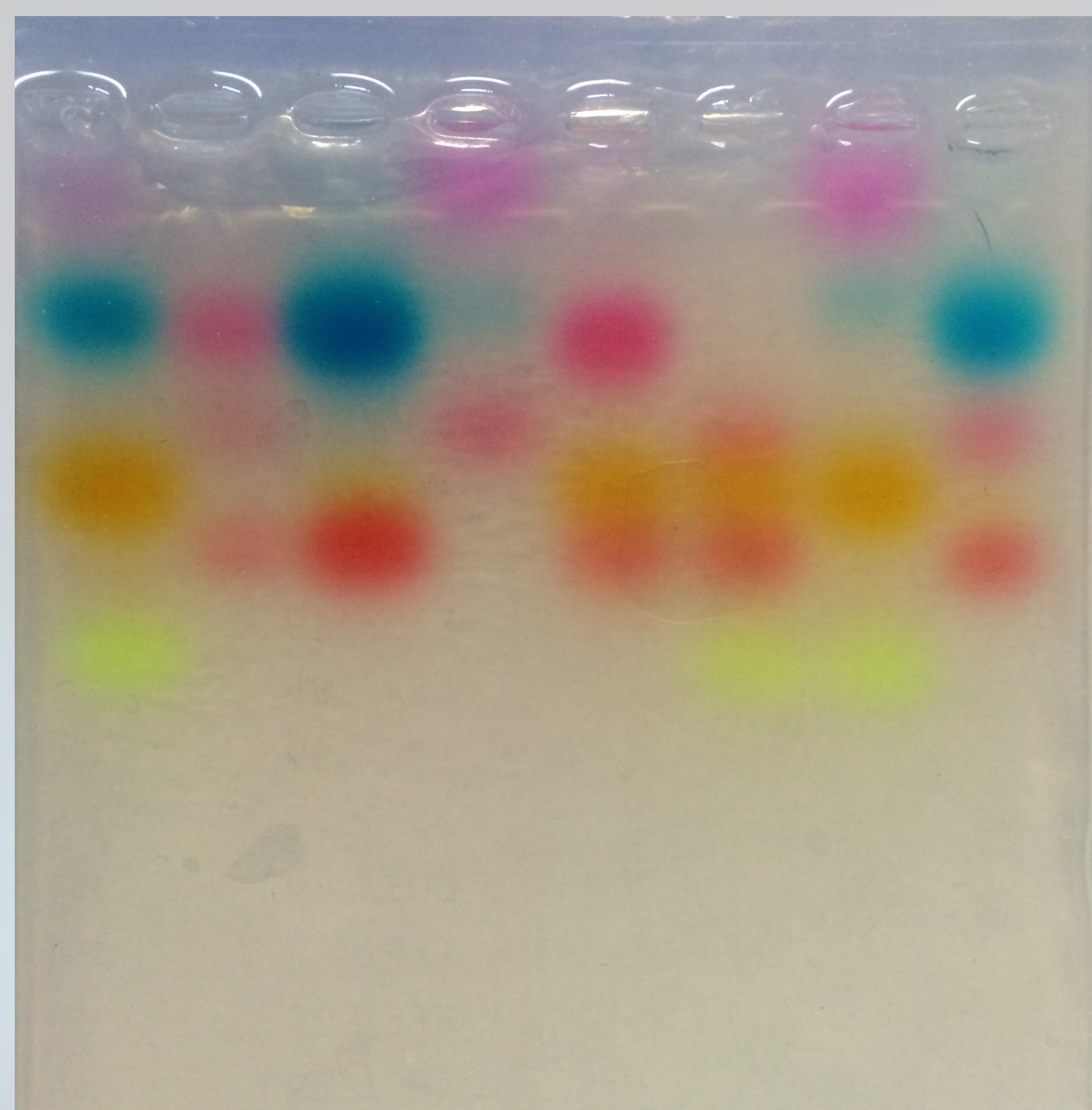
B1 (Brad and Angelina): Deep Pink FC, Orange CM, Red CM

B2 (Brad and Angelina): Pink CM, Orange CM, Red CM, yellow hi-lighter

B3 (Leonardo and Angelina): Purple CM, Orange CM, yellow hi-lighter

B4 (Leonardo and Jennifer): Black CM, Pink CM

Sample Gel



Sample Assessments

The gel below shows DNA fingerprint results for a mother, child, and three potential fathers.

1. Circle each band from the child that matches one of the bands from the mother.
2. Identify which of the men fathered the child.

Mother					
Child					
Man 1					
Man 2					
Man 3					

3. On the gel from the previous question, identify the location of the positive and negative electrodes.
4. Label the smallest band present on the gel above.

There was a potential mix-up in the hospital. Two babies may have been switched at birth. DNA fingerprints have been generated for both sets of parents and both babies. A size marker has been run on the gel in the first lane. It contains bands that are in multiples of 100bp (the smallest band is 100bp, the next is 200bp, then 300bp, etc). Listed below are the sizes of bands seen in the DNA fingerprints. Draw what the DNA fingerprint result would look like for all six individuals. Make sure and label each of the lanes with the sample that you are drawing in that lane.

- a. Mother A: 800bp, 550bp, 300bp, 150bp
- d. Father A: 700bp, 500bp, 200bp
- e. Baby A: 700bp, 550bp, 150bp
- f. Mother B: 800bp, 700bp, 300bp, 200bp
- g. Father B: 450bp, 400bp, 100bp
- h. Baby B: 800bp, 650bp, 350bp, 200bp

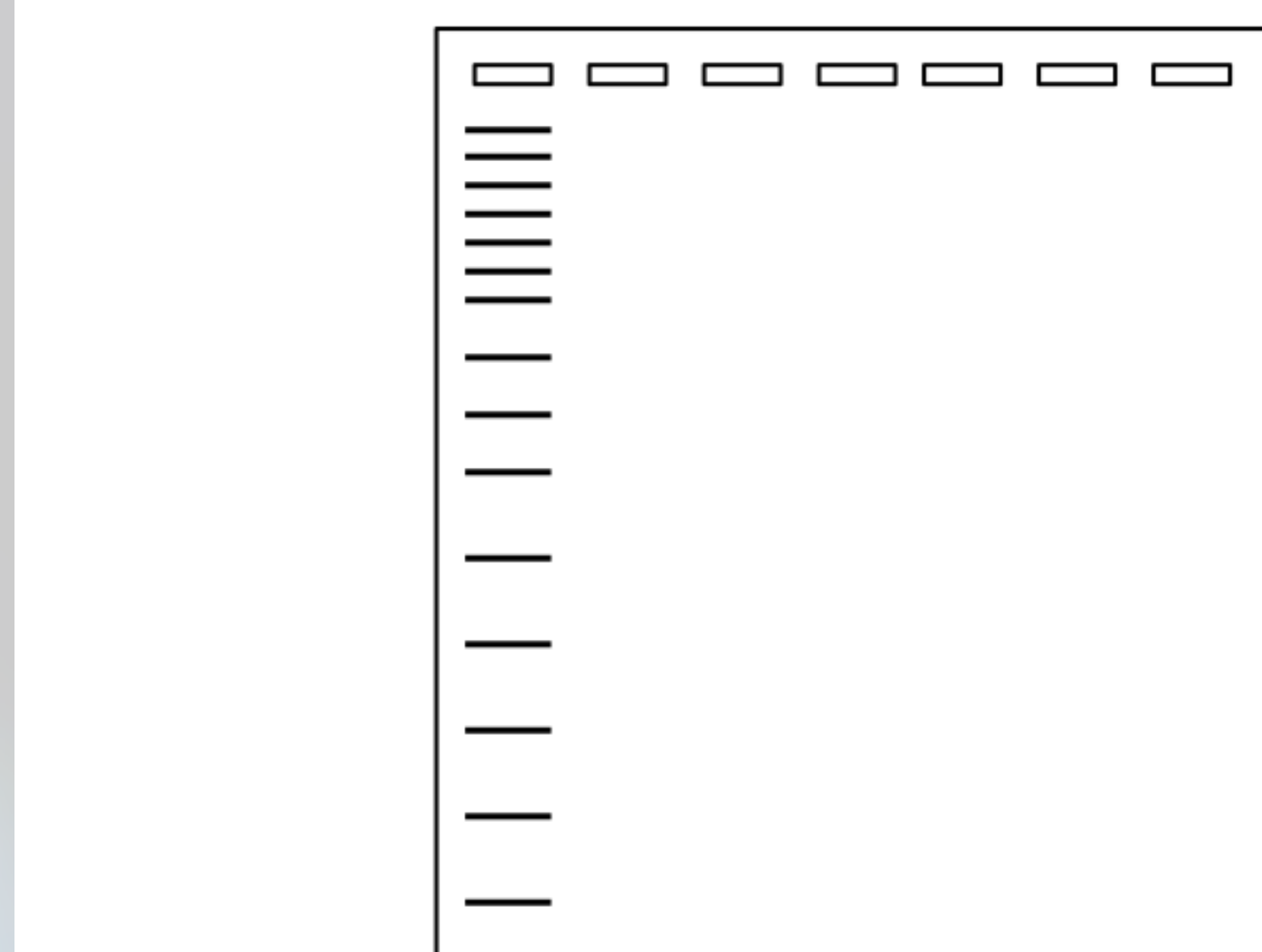
Sample Student Data and Conclusions

16. Draw a picture of your DNA fingerprint gel after it is finished running. Make sure to label which sample was loaded in each of the lanes. There are colored pencils available.

17. What is your conclusion?

B1 = A & B
B2 = A & B
B3 = A & L
B4 = J & L

Brad was right. Angelina cheated with Leonardo. Baby 1 and Baby 2 are Brad and Angelina. Baby 3 is Leonardo and his wife. Baby 4 is Angelina and Leonardo.



What conclusions can you draw from this DNA fingerprint?

Gel Preparation

4. Microwave 30g technical agar in TBE buffer until melted
*this bubbles a lot more than agarose when microwaved!

Agarose vs Technical Agar Prices from Sigma Aldrich

Agarose

SKU-Pack Size	Availability	Price (USD)	Quantity
A9539-10G	Available to ship on 06/10/14 - FROM	49.80	0
A9539-25G	Available to ship on 06/10/14 - FROM	94.50	0
A9539-50G	Available to ship on 06/10/14 - FROM	167.00	0
A9539-100G	Available to ship on 06/10/14 - FROM	259.50	0
A9539-250G	Available to ship on 06/10/14 - FROM	572.00	0
A9539-500G	Available to ship on 06/10/14 - FROM	986.00	0

Technical Agar

SKU-Pack Size	Availability	Price (USD)	Quantity
05040-100G	Available to ship on 06/10/14 - FROM	32.90	0
05040-250G	Available to ship on 06/10/14 - FROM	72.20	0
05040-1KG	Available to ship on 06/10/14 - FROM	253.00	0