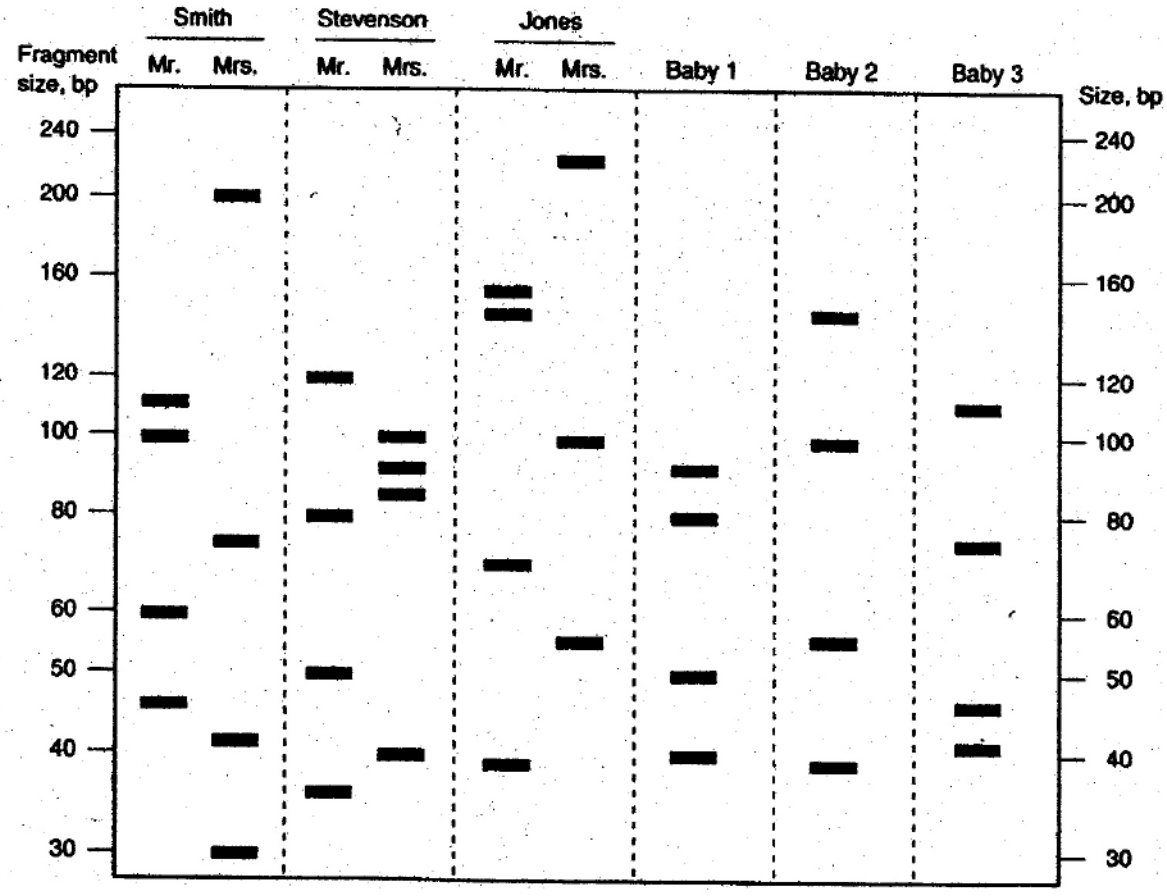
Exercise 1: A Mix-Up at the Hospital

The DNA sequence contains much more variety than is seen at the phenotypic level (outward traits). This variety can be detected by restriction length polymorphism (RFLP) analysis, by polymerase chain reaction (PCR) with variable tandem repeat regions (VNTR), or even by the sequencing of short regions of DNA. Unlike a blood type, a person's DNA sequence is as individual as his or her fingerprints (with the exception of identical siblings!)

One June 6 at approximately 1 PM; Mrs. Smith, Mrs. Stevenson, and Mrs. Jones each delivered a healthy baby boy at Windham Community Memorial Hospital. At 1:26 PM, the hospital's fire alarm sounded. Nurses and orderlies scrambled to evacuate patients, and- the three newborns were rushed to safety. After the danger had passed, the hospital staff was distressed to find that in the confusion, they had forgotten which baby was which. Since the babies were moved before receiving their identification bracelets there was no easy way to identify them. Dr. Anne Robinson, head of pediatrics, ordered that DNA typing be performed on the babies and their parents.

The DNA typing laboratory looked at two different highly variable chromosome regions. The DNA: profiles are shown below. Your job is to decide which baby belongs to which set of parents. To assign a baby to a set of parents, every band in the baby's profile should match a band from either the mother or the father. Not all of the bands in the mother's or father's profiles will have a counterpart in the baby's DNA profile. Use a ruler or straight-edge to help you line up the bands.



Exercise 2: *A Paternity Case*

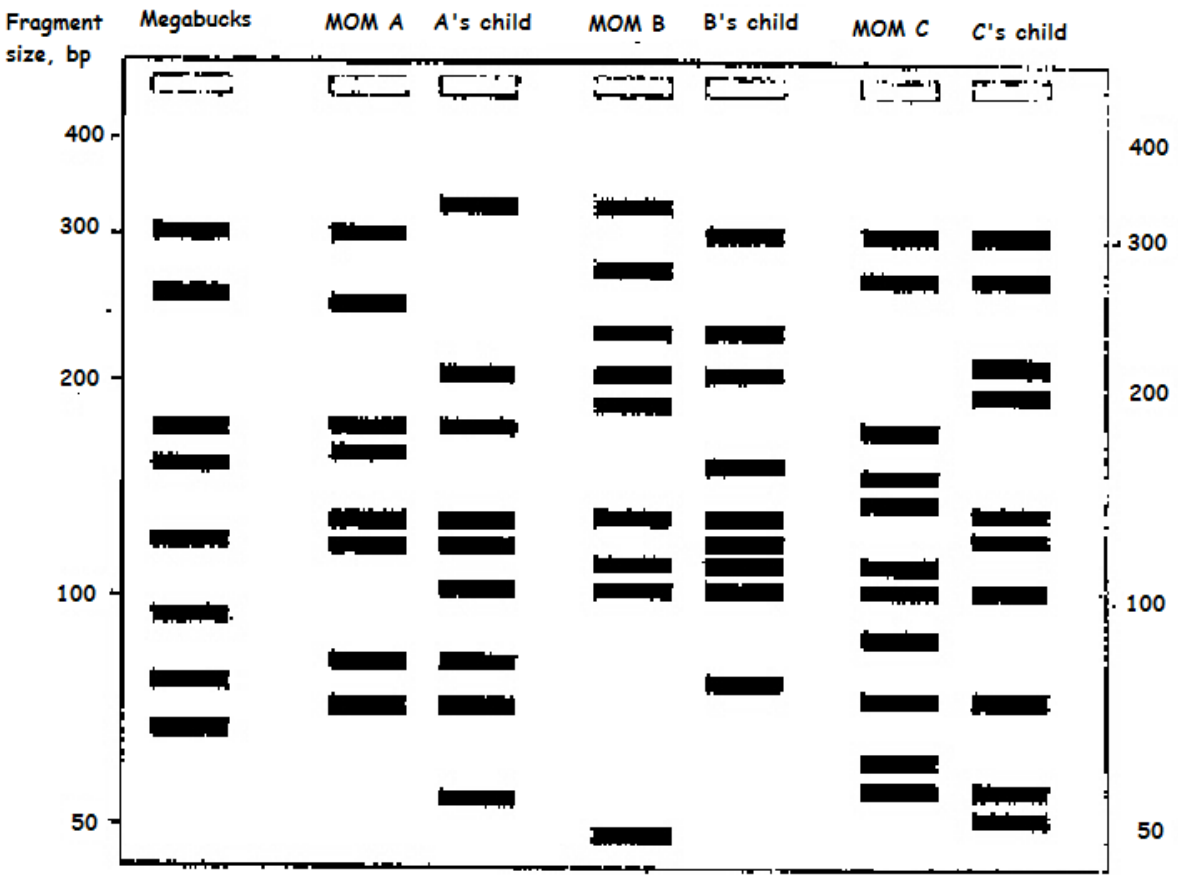
Mr. I.M. Megabucks, the wealthiest man in the world, recently died. Since his death, three women have come forward. Each woman claims to have a child by Megabucks and demands a substantial share of his estate for her child. Lawyers for the estate have insisted on DNA typing of each of the alleged heirs. Fortunately, Megabucks anticipated trouble like this before he died, and he arranged to have a sample of his blood frozen for DNA typing.

The results of RFLP analysis are shown below. Your job is to analyze the data and determine whether any of the children could be Megabucks' heir. Remember that every person has two of each chromosome, one inherited from his mother and one inherited from his father. Half of every person's DNA comes from his mother, and half comes from his father, so some of the DNA bands showing in the Southern blots of the children will come from their mothers, and the rest will come from their fathers. The question is, could that father be Megabucks.

For the first child, identify the bands in the DNA profile that came from the mother. Remember that not all of the mother's DNA is transmitted to the child; just one of each pair of chromosomes is transmitted. Mark the bands that come from the mother with an M. Circle the remaining bands.

Compare the remaining bands with the DNA profile from Megabucks. If he is the father, then all of the circled bands in the child's profile should have a corresponding band in his profile. Remember that only half of the father's chromosomes are transmitted to a child, so that not every band from the father would match the child's profile.

Repeat the analysis for the other alleged heirs. Could any of them be Megabuck's children?



Modified from: Jim Buckley http://www.ekcsk12.org/faculty/jbuckley/aplabreview/forensicsimulation.htm