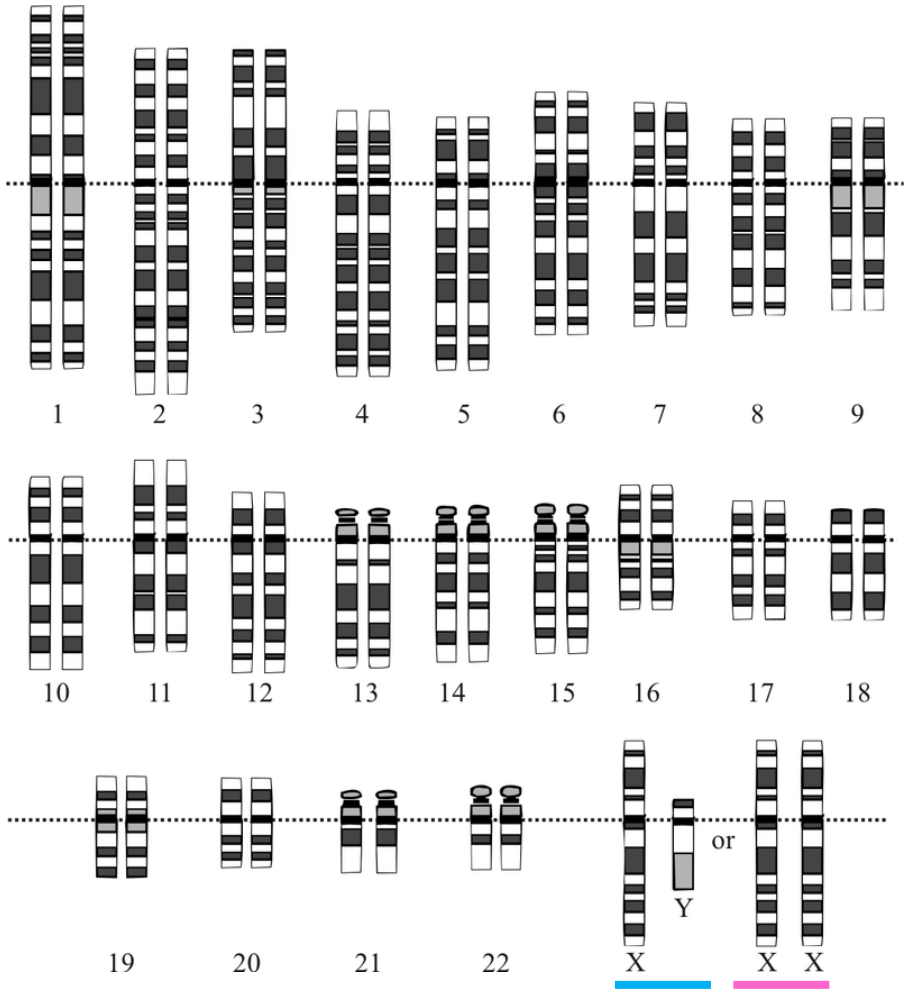
FORENSIC DNA ANALYSIS | Western blots separate human gene proteins distinguished by molecular weight (g/mol) using antibodies in gel substrate for identification (example)



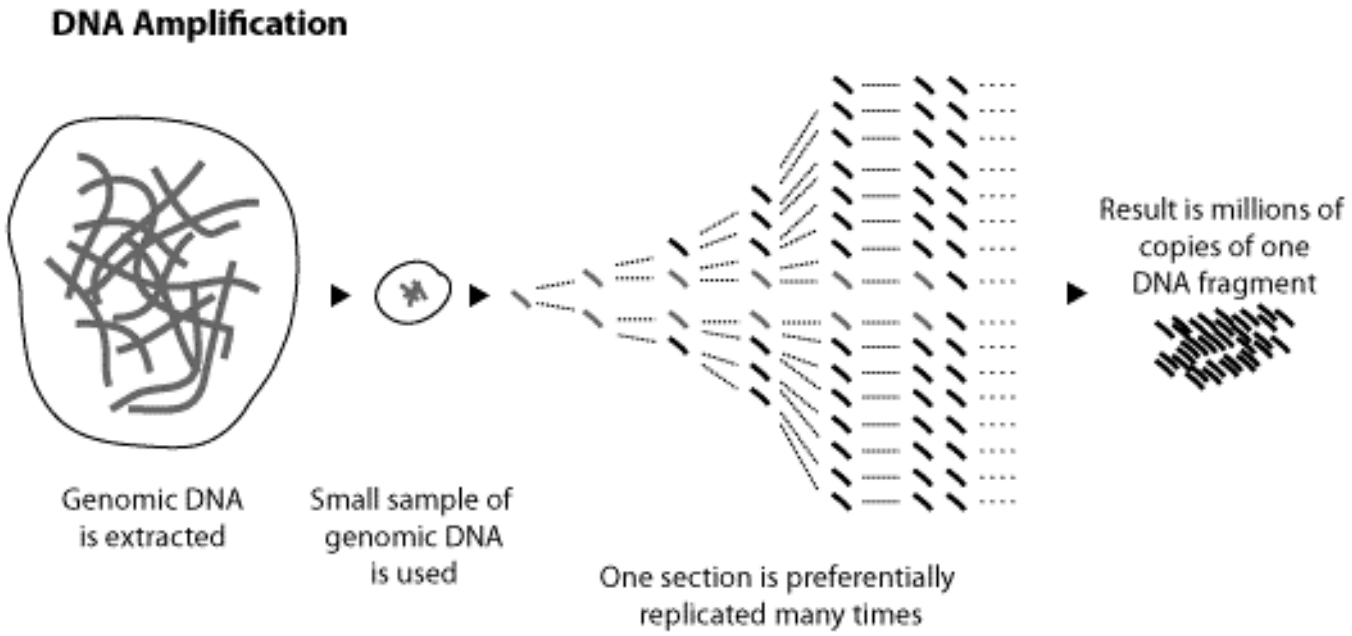
Figure, online source

For humans, there are 2 alleles for every gene (1 set from each parent) and 23 chromosome pairs (= 46 total).

Gene #23 indicates sex: XY male or XX female (refer to figure, lower corner).

Forensically, matching a minimum of ≈ 17 genes can potentially identify a suspect. And familial DNA can be a confounding factor.

DNA markers | Short Tandem Repeats (STRs)



Polymerase Chain Reaction (PCR) amplifies & replicates STRs for analysis (see figure)

The AK state crime lab looks at STRs using pre-fabricated (rape) kits

Most of our DNA is identical to the DNA of others. What makes us each distinct is the inherited sections of DNA which vary uniquely between individuals, known as *polymorphisms*:

→ **Short Tandem Repeats (STRs)**

DNA sequences with the highest degree of polymorphisms are most useful for forensic DNA analysis.

STRs are short sequences of DNA, typically 2 – 5 base pairs in length.

Base pairs:
A (adenine) - T (thymine)
C (cytosine) - G (guanine)

FORENSIC DNA ANALYSIS | Why mistakes happen

By analogy, consider the 'Birthday Problem' → Probability Theory

- Given a set of randomly chosen people, some pair of them will share the same birthday (month-day-year)
- The probability reaches 100% when the number of people reaches 367 (since there are only 366 possible birthdays, including February 29, leap day). However, 99.9% probability is reached with just 70 people, and 50% probability with 23 people.
- Based on the assumption that each day of the year (except February 29, leap day) is equally probable for a birthday.
- In a group of > 25, there is a high likelihood that at least 2 people will share the same birthdate

- Forensic Q (re: STR pre-fab kits): *How many replicates did you evaluate? Show your quality control protocol for amplification precision & accuracy.*

Genetics

While I am not a geneticist, I do know how to extract and analyze DNA from whole blood:

- Polymerase Chain Reactions
- Gel electrophoresis

Inside the Cell: The Dark Side of Forensic DNA

by Erin E. Murphy (2015)

Murphy is lawyer (Washington DC) whose practice focuses on Supreme Court, appellate & constitutional litigation

Modern info about forensic DNA