

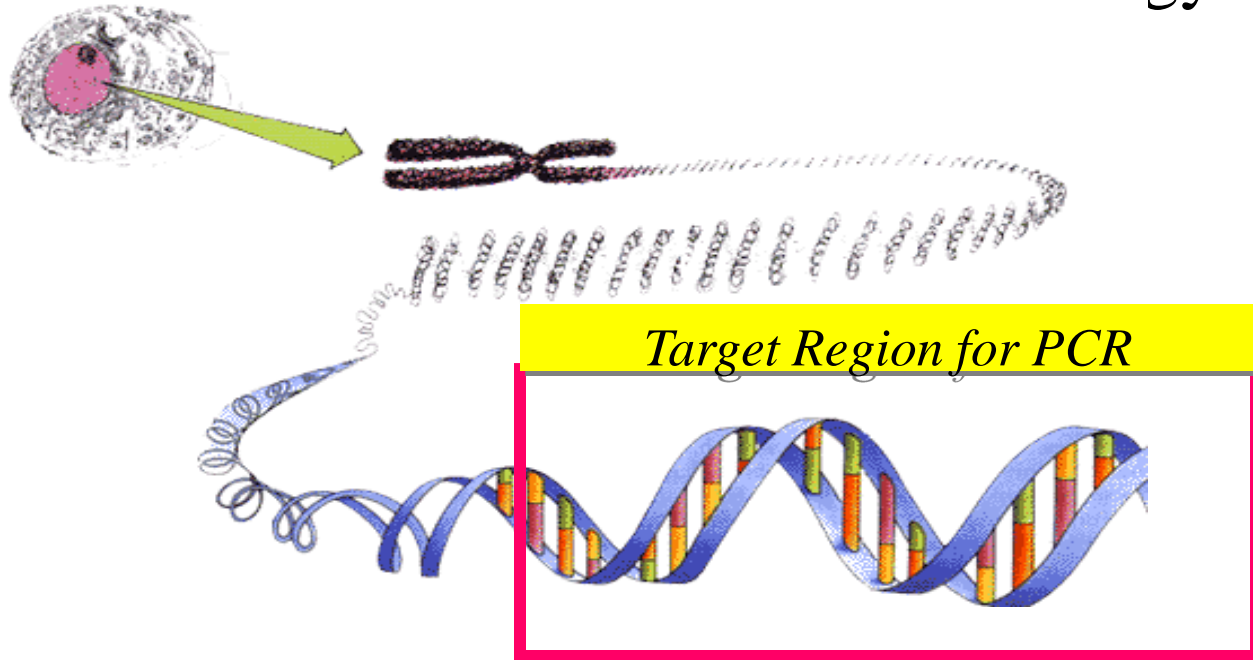
Forensic DNA Typing

Did you kill (rape, father...) that person?

How DNA can “definitively” say.

Adapted from:

National Institutes of Science & Technology



You can be identified by your own unique various regions

DNA Use in Forensic, Paternity... Cases

- Most Forensic cases are rape cases (>2 out of 3)
Looking for match between evidence and suspect
-- **matching suspect with evidence**
- Paternity testing -- **identifying father**
- Military DNA “dog-tag.”

Challenges

- Mixtures must be resolved
- DNA is often degraded (stored wet- have mold, nuclease)
- Inhibitors to PCR are often present

Sources of Biological Evidence

- **Blood**
- **Semen**
- **Saliva**
- **Urine**
- **Hair**

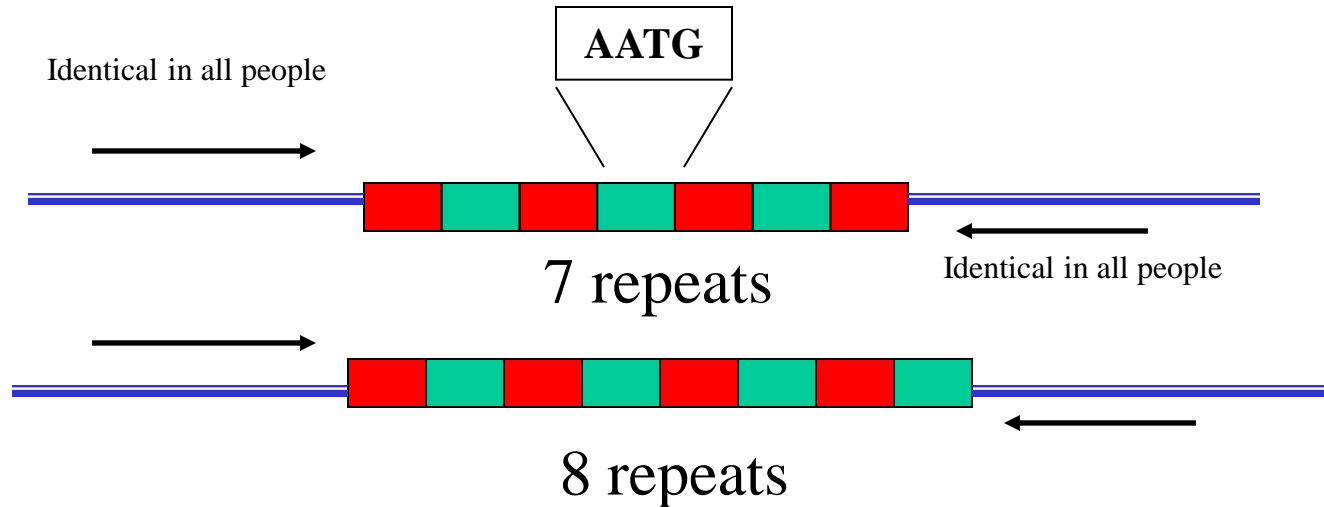


- **Teeth** (useful in fires).
- **Bone** (Yes, there are cells in bone. Decalcify it.
100,000 year old people, Dinosaurs- has DNA!)
- **Tissue**

All felony arrests- cheek swab.

Short Tandem Repeats (STRs)

(say chromo 3)



the repeat region is variable between samples while the flanking regions where PCR primers bind are constant

Homozygote = both alleles are the same length

Heterozygote = alleles differ and can be resolved from one another

Variation Among STRs

Choosing which STRs:

Significant statistical variation – but not too many.

Freq. that are measured in pop. : Loc 1 -10%. Loc 2 – 10%; locus 1+2 -1/100.

Random match with 13 primers (used now): $1/10^{13}$.

(There are 6 billion people, $\sim 6 \times 10^9$ people.)

Watch out for different racial types!

Multiplex PCR

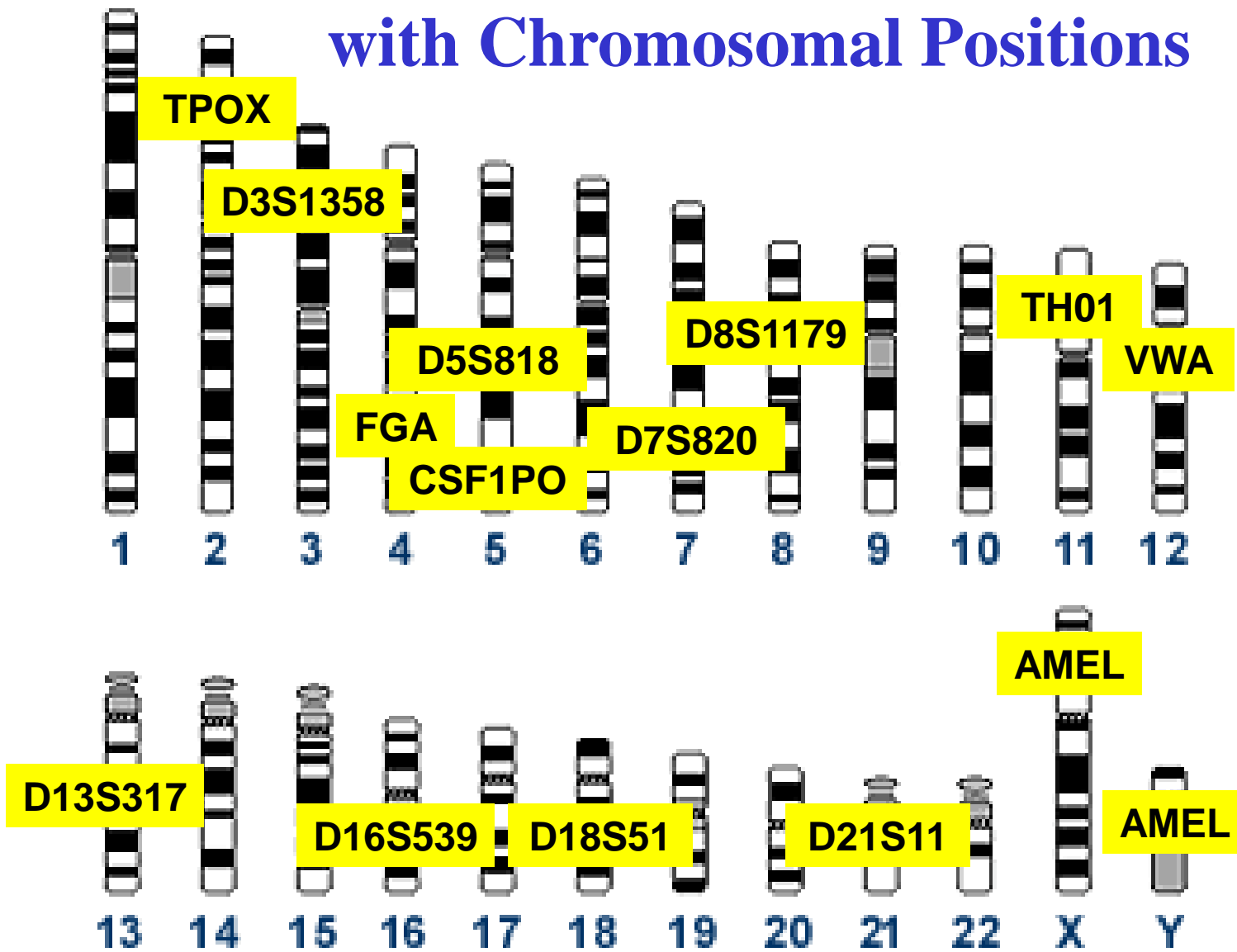


- Over 10 Markers Can Be Copied at Once
- Sensitivities to levels less than 1 ng of DNA
- Ability to Handle Mixtures and Degraded Samples
- Different Fluorescent Dyes Used to Distinguish STR Alleles with Overlapping Size Ranges

Most rxns: require 2 PCR (tubes) 7 or 8 primer pairs in one tube— need total of about 2 tubes for 13 different STRs.

\$20-\$25 per rxn in lab. \$150 incl labor. Cost for forensic up to \$1000.

13 CODIS Core STR Loci with Chromosomal Positions



D tells chromosome 21— Can tell Down's syndrome. (No Down's here.)

Human Identity Testing with Multiplex STRs

Amelogenin protein is involved in tooth enamel and happens to be on sex chromosome

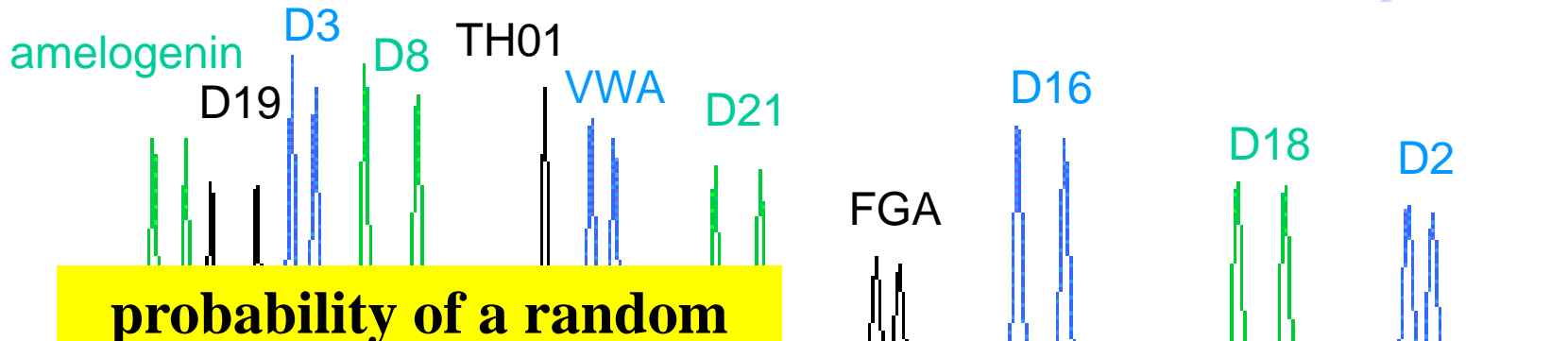
AmpFlSTR® SGM Plus™ kit



2 peaks: x (106 bp) & y (112 bp)

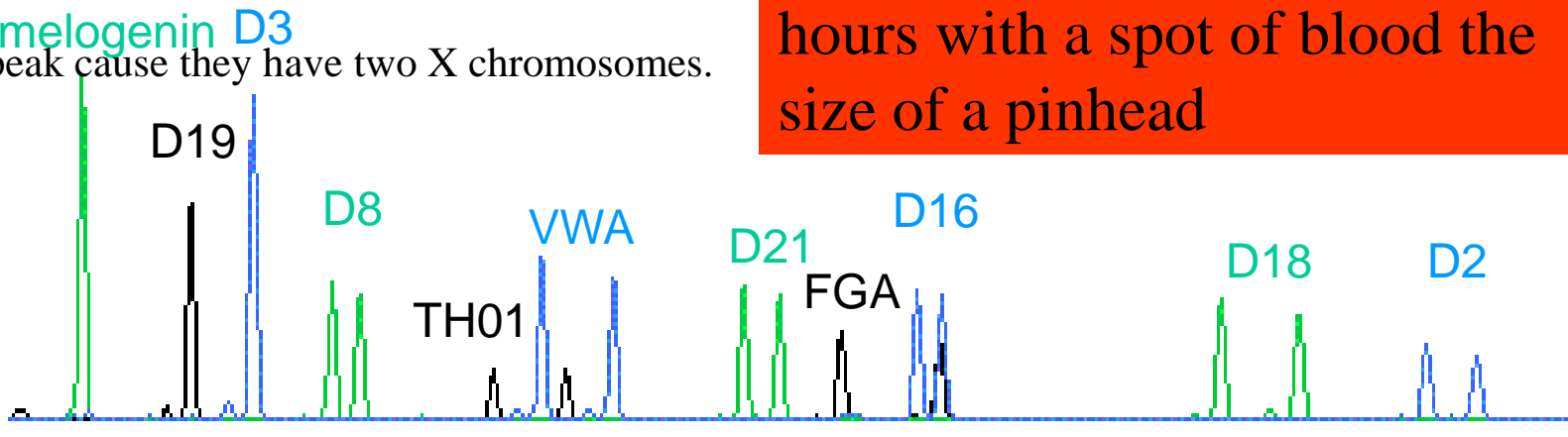
DNA Size (base pairs)

Two different individuals



Results obtained in less than 5 hours with a spot of blood the size of a pinhead

Only 1 peak cause they have two X chromosomes.



Simultaneous Analysis of 10 STRs and Gender ID

FBI' s CODIS DNA Database

Combined DNA Index System --all 50 states can upload their convicted felony and seq. of unsolved cases.... In Florida to convicted felon.

- Used for linking serial crimes and unsolved cases with repeat offenders
- Launched October 1998
- Links all 50 states
- Requires >4 RFLP markers and/or 13 core STR markers
- Current backlog of >600,000 samples



Except for police errors, and sufficient racial typing,
its a done deal

Class evaluation

1. What was the most interesting thing you learned in class today?
2. What are you confused about?
3. Related to today's subject, what would you like to know more about?
4. Any helpful comments.

Answer, and turn in at the end of class.