DNA - 101

WHAT IS IT? WHY IS IT IMPORTANT? WHAT DO I NEED TO KNOW?

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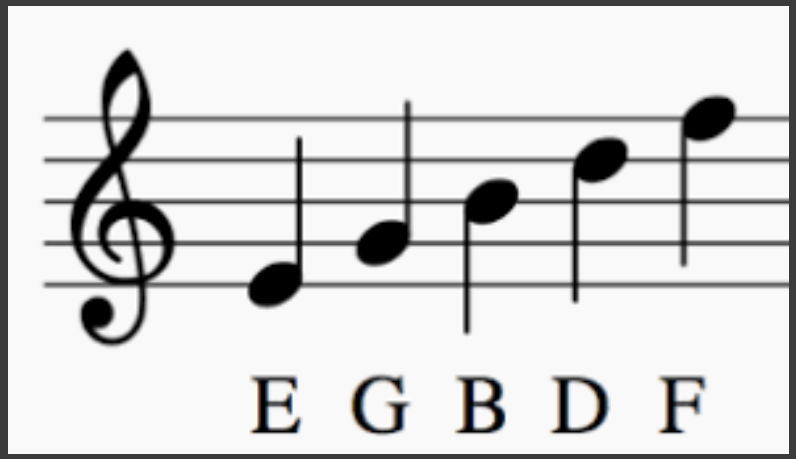
What Is DNA?

- Deoxyribonucleic acid
- Genetic Coding or Blueprint
- Present in cell nucleus

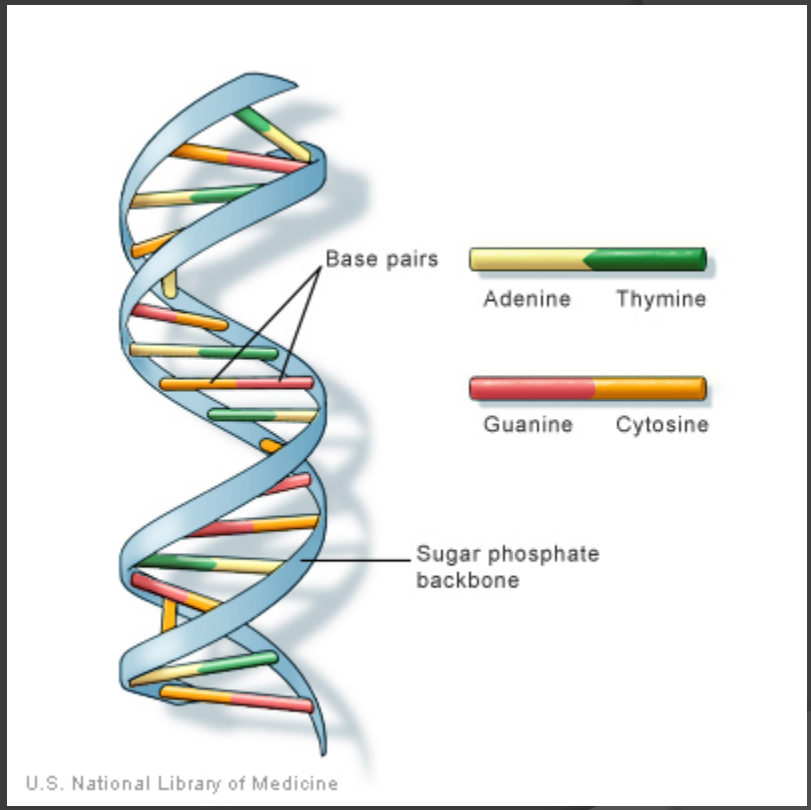
What Is DNA?



- Four bases
  - Adenine [A]
  - Cytosine [C]
  - Guanine [G]
  - Thymine [T]

Base pairs

- 3.2 billion base pairs
- 99.9% of sequence is nearly identical
- Forensic DNA testing looks at ~3,000 BPs where there are known differences



Where do Analysts Look?

- Locus
  - Same Spot on Same Chromosome
- 13 core CODIS loci
  - CSF1PO
  - D3S1358
  - D5S818
  - D7S820
  - D8S1179
  - D13S317
  - D16S539
  - D18S51
  - D21S11
  - FGA
  - THO1
  - TPOX
  - VWA

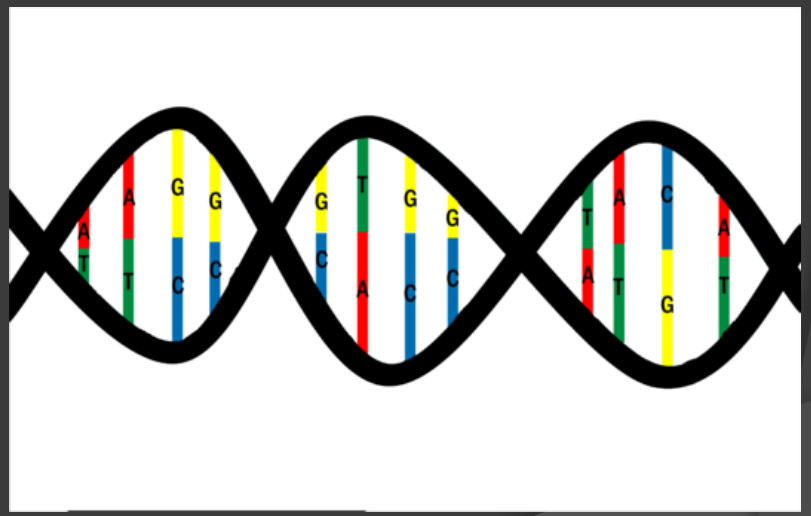
What are analysis looking at?

- Allele
  - Pattern types
  - Inherit one from mother and one from father
  - Sometimes identical – homozygous
  - Sometimes different – heterozygous
- Example: THO1
  - 8 observed alleles – 5, 6, 7, 8, 9, 9.3, 10, 11

What makes Alleles different?

- Alleles vary by length.
  - I.e. type 5 is much shorter length of DNA than type 10

- TH01 Example:
  - Pattern is AATG
  - Type 5:



AATGAATGAATGAATGAATG

  - Type 9:

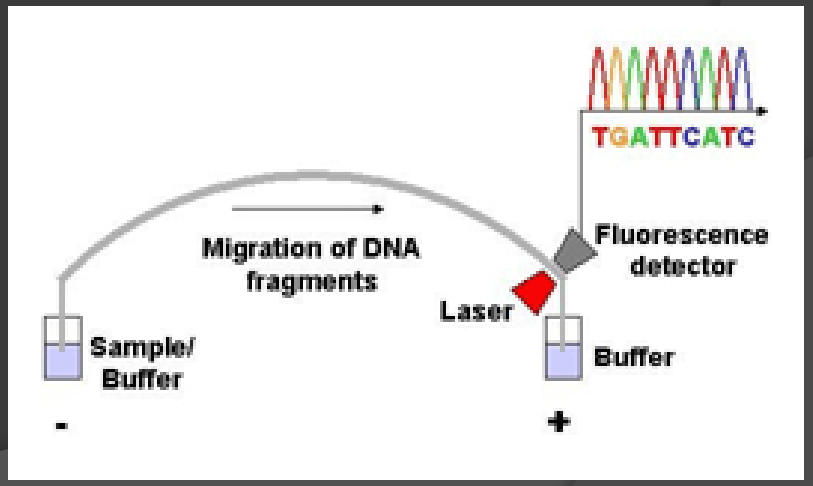
AATGAATGAATGAATGAATGAATGAATGAATGAATG

How does DNA analysis work?

- First isolate loci of concern
  - Reagents / Primers
  - Identify loci and mark start / end of the DNA strand
- Polymerase Chain Reaction (PCR)
  - Makes copies of DNA at loci
  - Adds dye to differentiate loci
- Minimum quantities needed
  - Minimum ~16-32 cells (100-200 pictograms)
  - Most DNA kits recommend 0.5-1.0 nanograms (500-1,000 pictograms or 80-160 cells)

Analyzing the DNA

- Capillary Electrophoresis (CE)
  - Capillary draws out small amount of amplified mixture
  - DNA moves in predictable fashion
    - Small fragments faster
    - Larger fragments slower and reach end last
  - Laser light at end of capillary illuminates fragment
  - Camera captures emitted light



Electropherogram

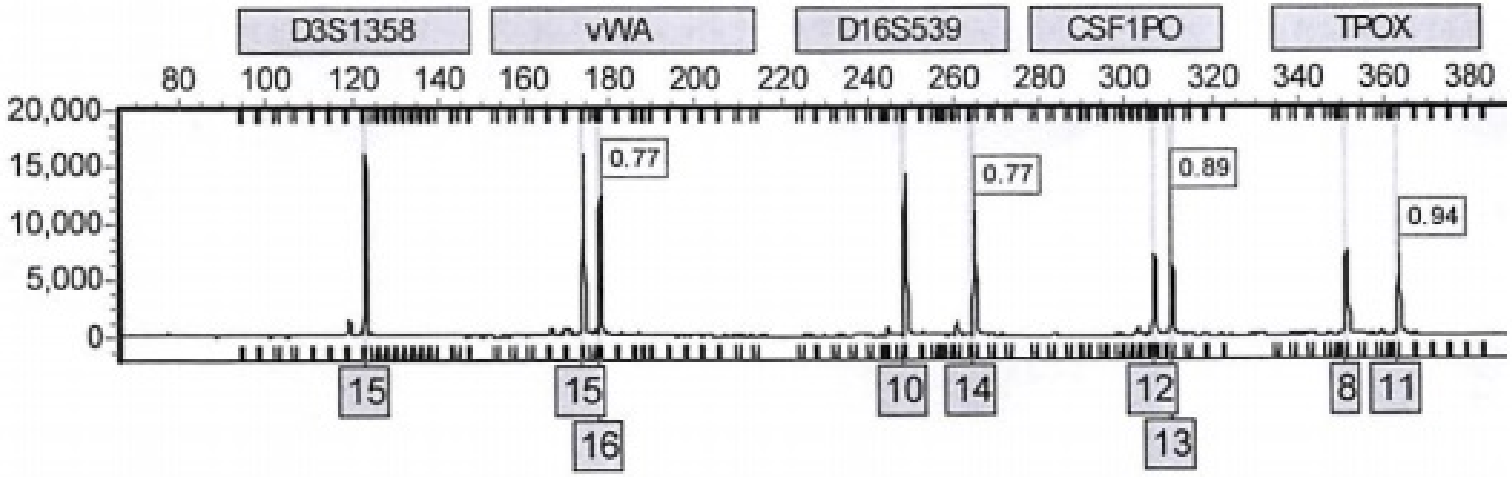
SoftGenetics **Allele Report**

GeneMarker HID V2.5.3

Project Comments:
A27538 (905W-174L)

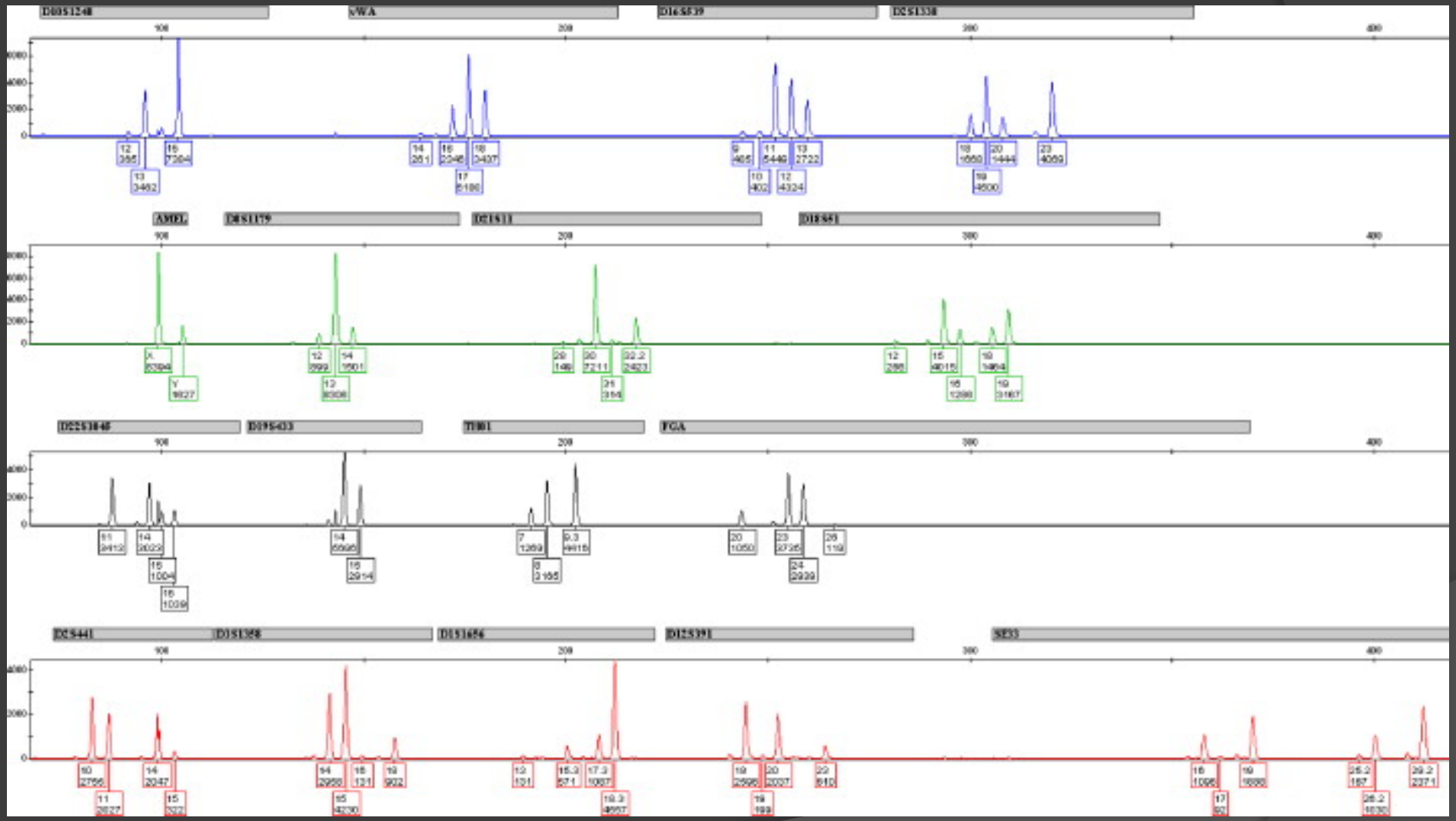
Sample 1: Run date and time: 12/16/2015 - 13:29:01 -> 12/16/2015 - 14:00:04

Dye: Blue - 9 peaks - 8321295-20_D02_005_0905.fsa



Single Source

Electropherogram



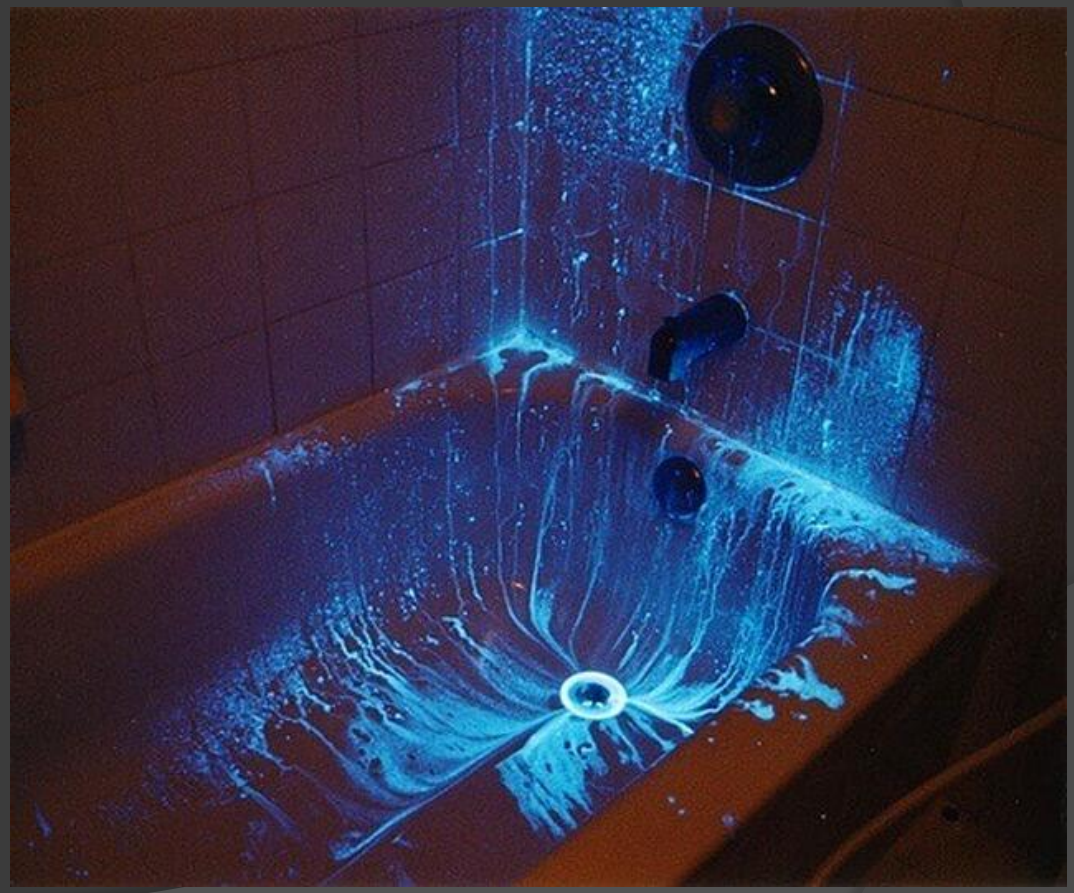
Mixture

Where is DNA found?

- Blood
- Semen
- Hair pulled from body
- Skin
- Saliva

Serology

- Presumptive testing
- Confirmatory testing



Types of DNA testing

- Autosomal nDNA (STR)
  - Most common, looks at CODIS loci
- Amelogenin
  - Gender determination
- Low-quantity template / Low copy
  - Amounts below 0.1 nanogram (100 pictograms)
- Y-STR
  - Y-Chromosome DNA inherited from father
  - All males in paternal lineage have same profile
  - Allows lab to isolate male DNA

Types of DNA testing

- Mitochondrial (mtDNA)
  - Found in cytoplasm of cell (area around nucleus)
  - Present in much larger quantities
  - All maternal relatives share same mtDNA
  - Only looks at two areas HVI, HVII

Report Conclusions

- Inclusion / Match
  - Evidence sample matches known sample
  - Statistical strength of match reported
- Exclusion
  - Only requires one different locus
- Inconclusive / Uninterpretable
  - Absence of DNA
  - Insufficient quantity of DNA
  - Degraded DNA
  - Substance that inhibits PCR such as denim dyes, carpet glue
  - Improper / Incomplete testing

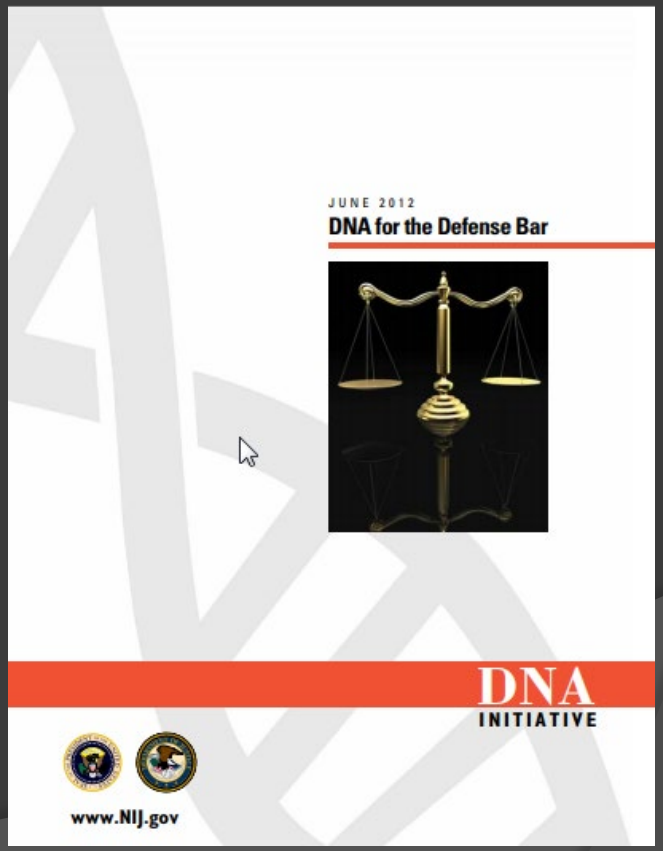
What to do with DNA case?

- **Theory??**

- Discovery Request
- Talk it over
- Expert

Reference

- https://www.ncjrs.gov/pdffiles1/nij/237975.pdf



QUESTIONS