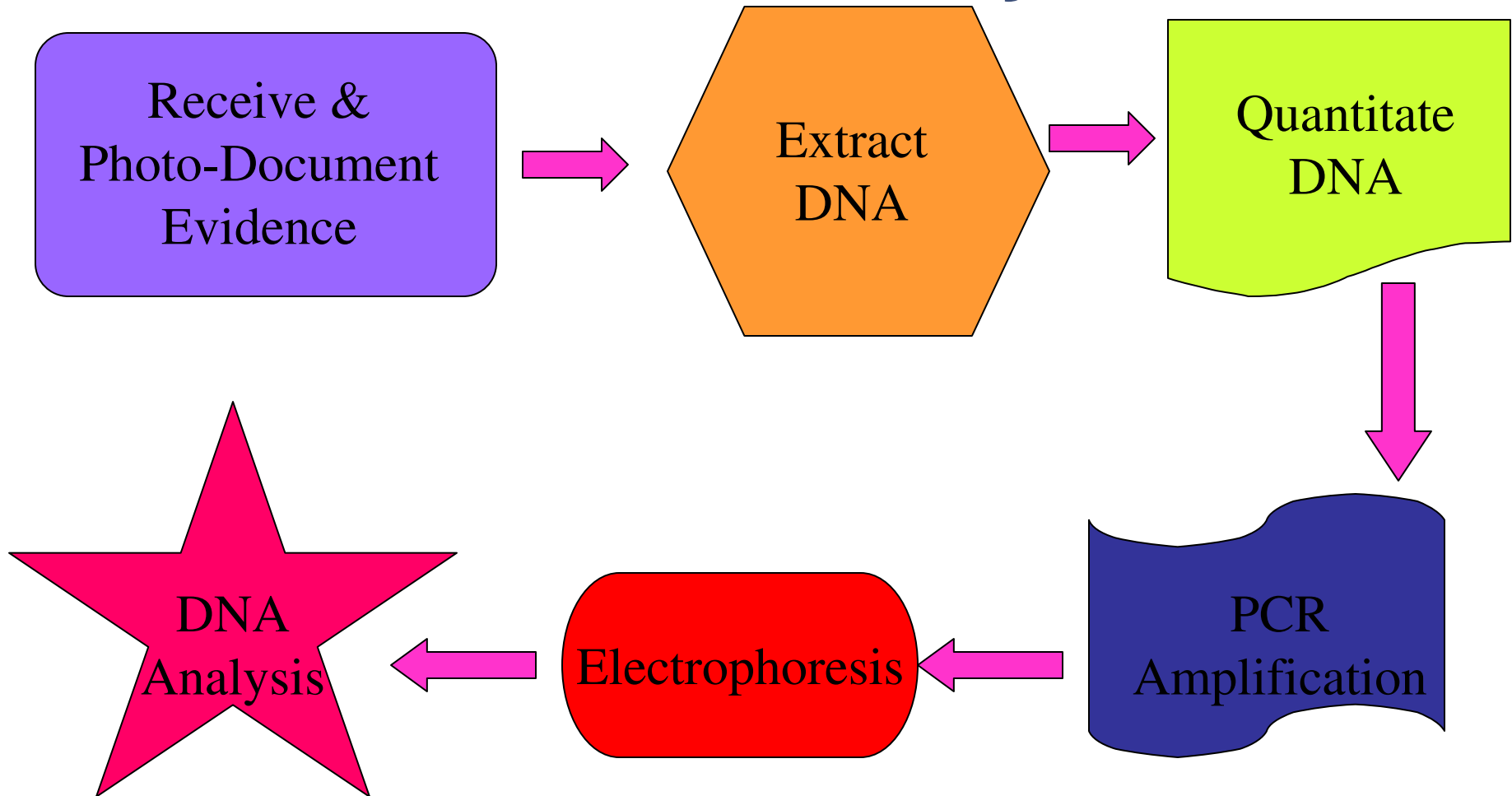


- What is DNA?
- How do we get DNA from evidence?
- What is Nuclear DNA?
- What are STRs?
- What are MiniSTRs?
- What are Y-STRs?
- What is mtDNA?
- What is Touch DNA?





# The Forensic DNA Analysis Process



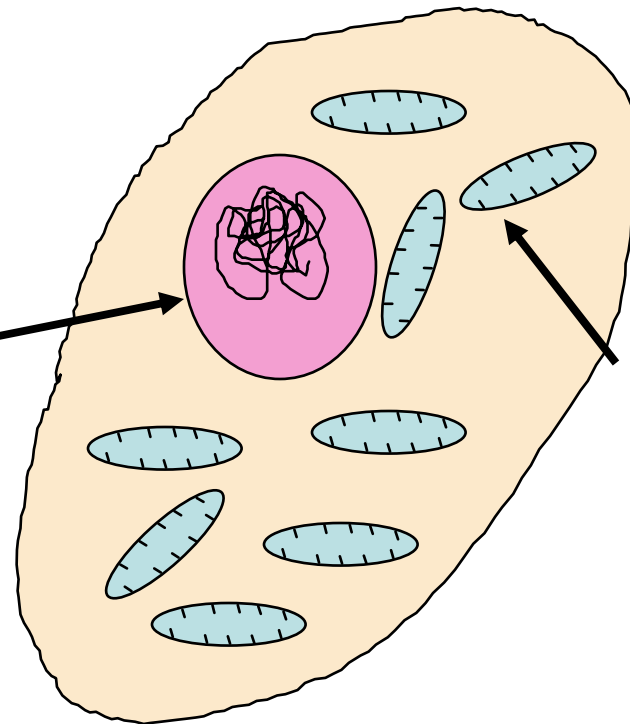


# Types of DNA

CELL

Nucleus- “brain”  
contains nuclear  
DNA

STRs/YSTR testing



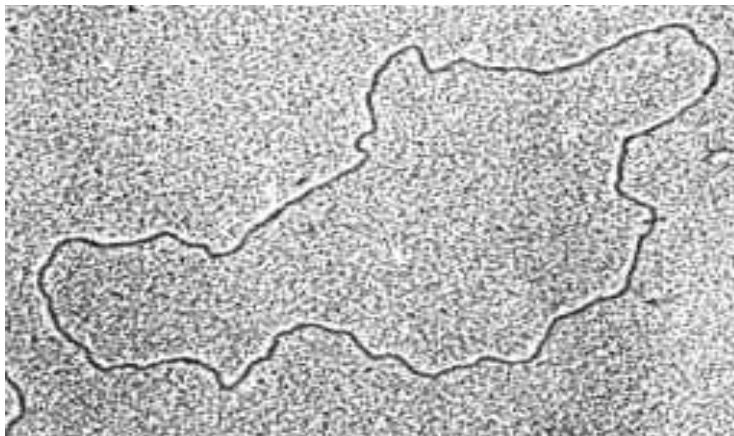
Mitochondria- “power house”  
contains mitochondrial DNA

mtDNA testing





## mtDNA



Shape: Circular

Genetic Alphabet: 16,569 base pairs

Copies per Cell: 100's-1000's

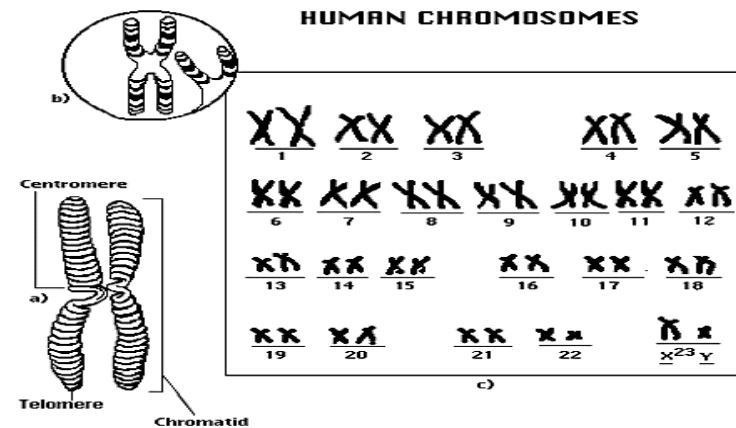
Inherited: 100% Mother

Location in Cell: Mitochondrial

Unique: NO

vs.

## nuc DNA



Shape: Linear

Genetic Alphabet: ~3 billion base pairs

Copies per Cell: 2

Inherited: 50% Mom and 50% Dad

Location in Cell: Nucleus

Unique: YES





# Short Tandem Repeats (STRs)

- Short segments of our DNA (**commonly 4 bases**) that are next to each other (**tandem**) and repeat over and over again (**STR testing counts the number of times the segment repeats**)
- In non-coding regions of our DNA
  - Do not tell you anything about the person's physical features, medical conditions etc
- Highly variable among individuals





# Short Tandem Repeats (STRs)



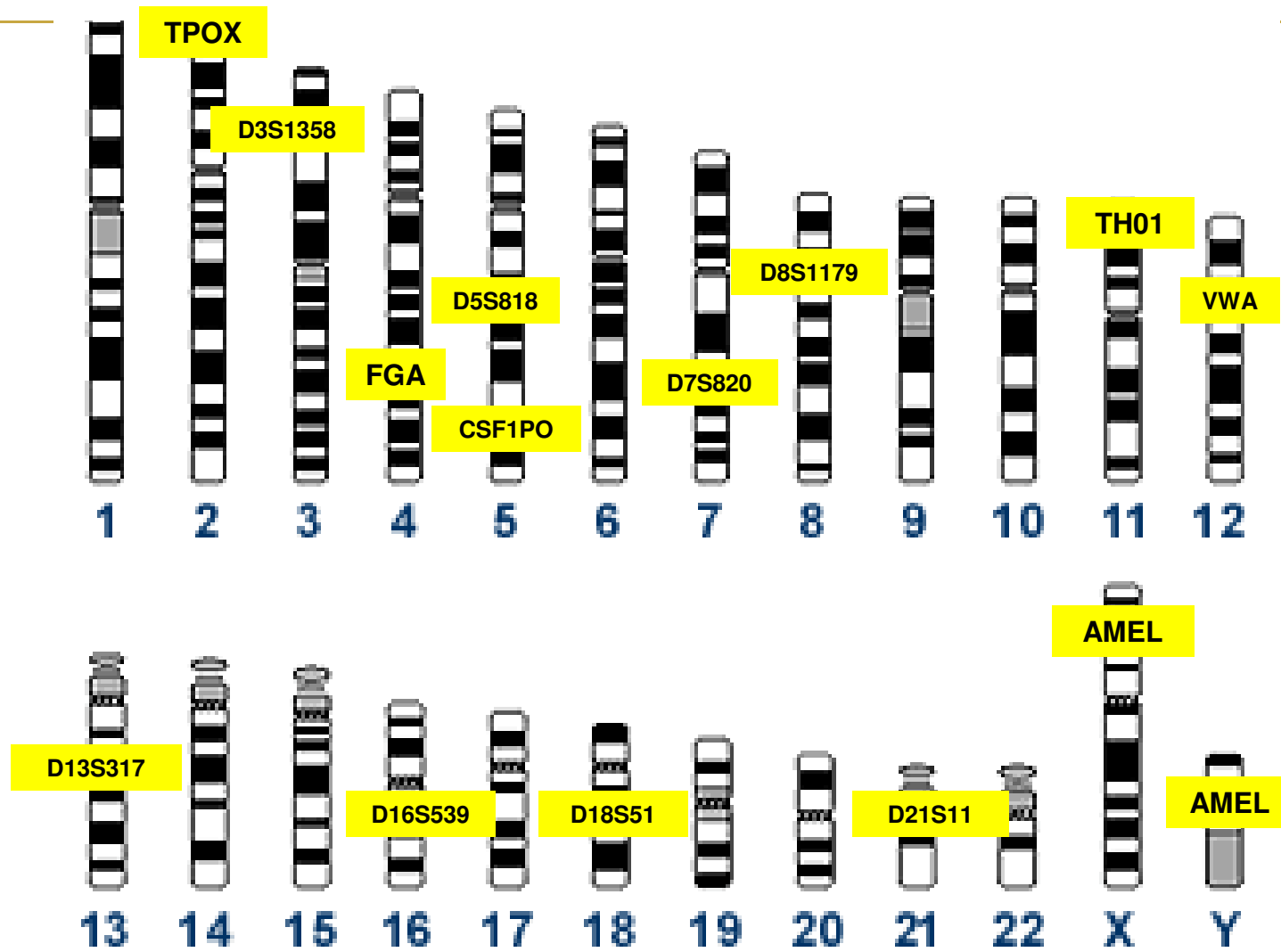
**DNA Profile =4,6**

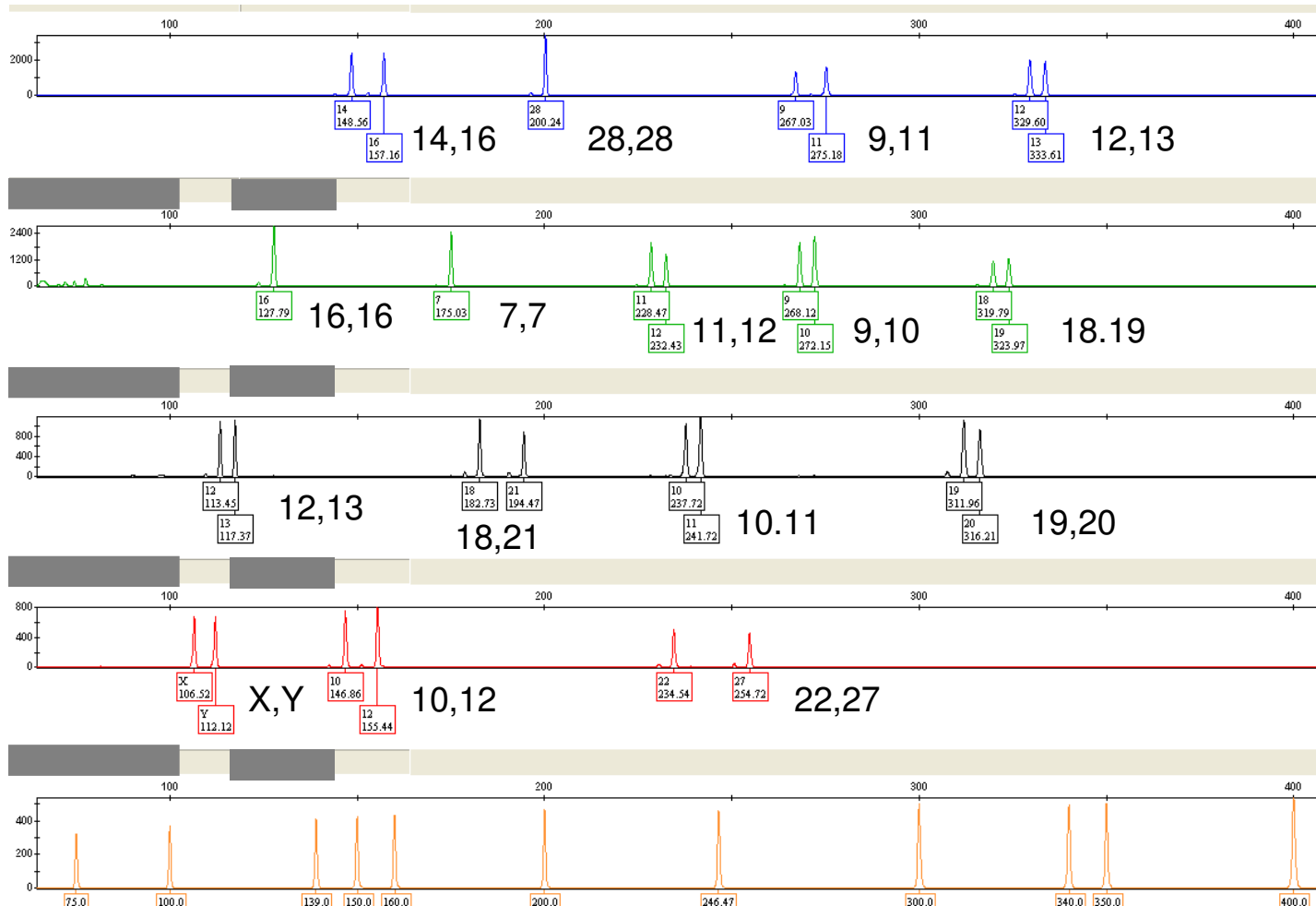


**DNA Profile =5,7**



# 13 CODIS Core STR Loci with Chromosomal Positions







# What can we get DNA from?

- **Just about anything containing biological matter-**
  - Blood, semen, saliva, Touch DNA (skin cells), mucous, tears, bones
  - Murder weapons- knives, guns, bats
  - Sex Toys, condoms
  - Clothing, household objects, cars
  - Paper products- tissues, toilet paper, ransom letters, stamps
  - Feces, Vomit, Urine, Sink Traps, Half-eaten food





# How Much Sample do you Need?



Older Testing Methods



STR DNA Analysis





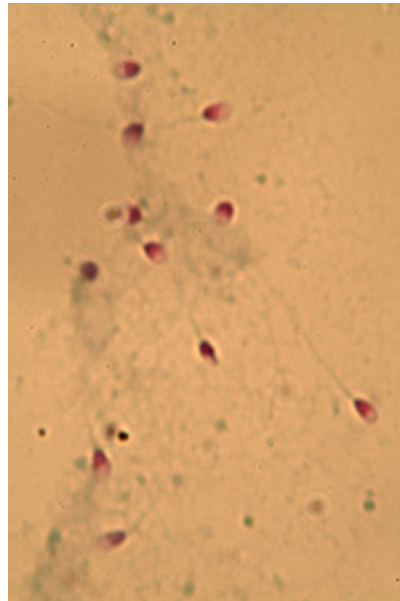
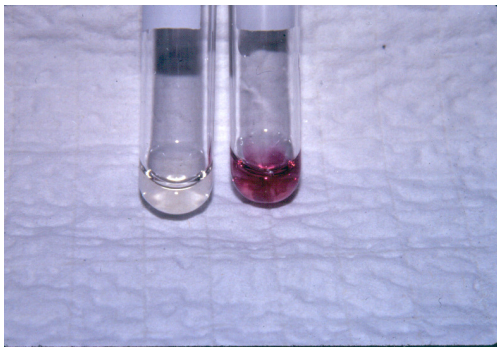
## Available Serology Screening Methods

- Semen:
  - ALS- Crimelite 430-470nm and Rofin Filter Goggles
  - Acid Phosphatase
  - P30
  - Microscopic Sperm Search

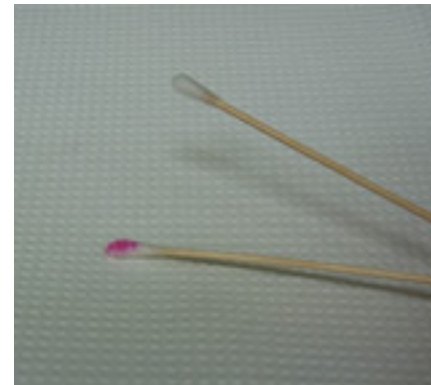




## AP, Sperm, and p30 test



- Saliva
  - ALS
  - Phadebas
- Blood
  - Phenolphthalein
  - Hematrace



- STR
- Y-Screen/Quant Duo
- Y-STR
- MiniFiler™
- Mitochondrial DNA
- Paternity testing/Complex Kinship Analysis
- Touch DNA
- DNA from Latent Prints





- If DNA is degraded the larger fragments of DNA get broken down into smaller fragments
- Traditional STRs cannot find the smaller fragments and therefore they do not get amplified
- MiniSTRs recognize the smaller fragments and amplify them producing results for a previously “lost loci”





**Bode**  **Technology™**

# Quantifiler® Duo

- **Highly Accurate:** determines the ratio of human male to female DNA, even with minute male and excess female DNA (1:1000 or greater)
- **Guides selection of the optimal PCR Amplification Kit** (autosomal, Y STR or MiniSTR)
- **Improves prediction of STR amplification performance and estimation of DNA quantity in degraded samples**
- **Detects the presence of PCR inhibitors** (suggesting additional purification of extract and/or MiniFiler™ kit analysis may be necessary)
- **Highly Sensitive:** 6 pg/μl limit of detection
- **Highly Specific:** for human and higher primate DNA
- **Highly Efficient:** dual quantification system minimizes sample consumption and streamlines workflow





- Y-STR testing targets the Y chromosome only found in males
- Y chromosome is passed down generation to generation
- Help resolve the male component of a male/female mixture without amplifying the female DNA
- Can track paternal lineage
- Two kits on the market PowerPlex® Y and YFiler™





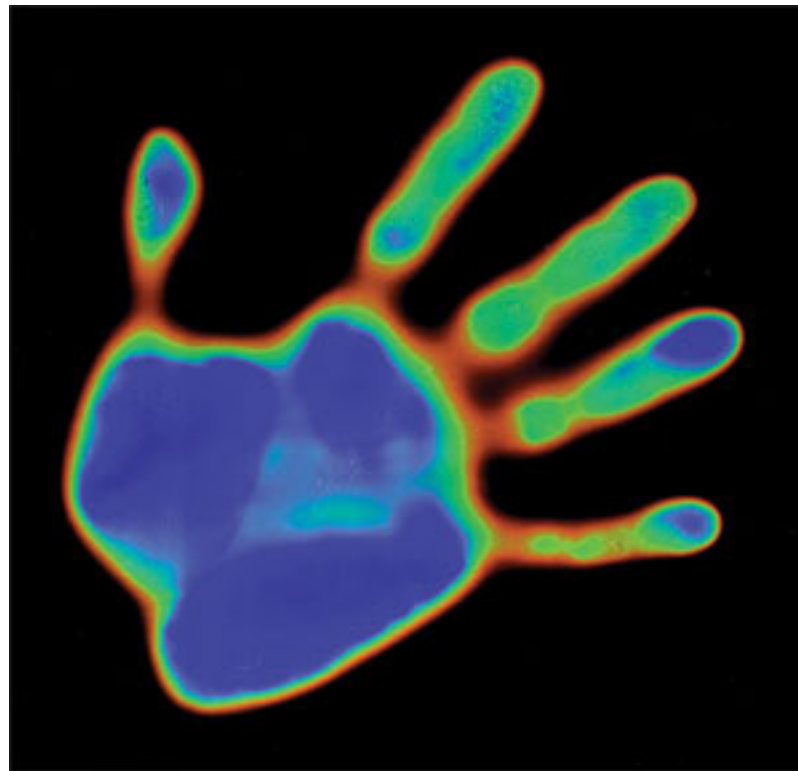
- Ability to obtain DNA profiles from evidence that is not suitable for nuclear DNA analysis e.g. hairs without roots/follicular material.
- Can obtain a mtDNA profile from a single hair shaft.
- Excellent method for obtaining DNA profiles from degraded/old samples since mtDNA is more abundant than nuclear DNA.
- But- not as discriminating as nuclear DNA since any maternally related individuals will share the same mtDNA profile.





Bode  Technology™

# Touch DNA





# Bode Technology™ Touch DNA- what is it?

- Touch DNA refers to the DNA that is left behind from skin cells when a person touches or comes into contact with an item.
- Humans shed tens of thousands of skin cells each day, and these cells are transferred to every surface our skin contacts.
- When a crime is committed, if the perpetrator deposits a sufficient number of skin cells on an item at the scene, and that item is collected as possible evidence, touch DNA analysis may be able to link the perpetrator to the crime scene.
- However, since Touch DNA is usually deposited in smaller amounts than the DNA found in bloodstains or other body fluids, it is more difficult to obtain DNA profiles from touch DNA samples.





- Touch DNA is not Low Copy Number DNA:
  - LCN DNA profiling allows a very small amount of DNA to be analyzed, from as little as 5 to 20 cells.
  - Because of the small amount of starting DNA in LCN samples, many more cycles of amplification are necessary.
  - LCN is not currently readily accepted in courts in the USA.
- Touch DNA samples are processed exactly the same way as blood, semen, saliva etc
  - i.e. you need ~300 skin cells to obtain a DNA profile using conventional profiling techniques.
  - Touch DNA samples are admissible in court and have been testified to 1000s times worldwide.





# Touch DNA- how do you sample it?

- The key to obtaining successful Touch DNA results depends on recognizing items/areas on items which may be suitable for Touch DNA analysis, and using the sampling technique that will recover the highest number of skin cells:
  - » Swabbing: non-porous surfaces
  - » Cutting
  - » Scraping
  - » Tape-Lifts
  - » Post-It Notes





- **Specialized DNA and sampling techniques can help solve cases:**
  - Quantifiler Duo: can detect minute amounts of male DNA
  - Y-STR: can help resolve mixed DNA samples where female DNA may be masking the male suspect DNA
  - mtDNA: can assist in cases where nuclear DNA is too degraded or not present in sufficient quantities
  - MiniFiler™: can obtain profiles from degraded or low level samples
  - Touch DNA: sampling for Touch DNA can help identify suspect(s) in cases where body fluids are not present

