

# Laboratory Services Bureau

## FORENSIC DNA



PROVIDING THE HIGHEST QUALITY FORENSIC SCIENCE SERVICES TO THE CITY OF PHOENIX

The Forensic DNA section is comprised of DNA lab analysts, DNA interpretation analysts, lab technicians, CODIS administrators, and supervisors. This unit processes several thousand requests for analysis each year.

Evidence that has been screened for biological material by the Evidence Screening Section (ESS) and determined suitable for DNA processing is then passed to the lab analyst to generate a DNA profile through a four-step process. The interpretation analyst then evaluates the DNA profiles, compares any suitable profiles, generates a report, and enters any eligible profiles into CODIS.



**Deoxyribonucleic Acid (DNA)** is the blueprint of life or the genetic make-up that makes each individual unique and identifiable. Only identical siblings have the same DNA. It is inherited directly from a person's biological parents – half of an individual's DNA comes from the father and half from the mother.

### LIMITATIONS TO DNA ANALYSIS

- \* DNA cannot determine when a person was at the crime scene
- \* DNA does not determine consent in sexual assault cases
- \* DNA cannot determine how it was left on the evidence
- \* Sometimes complex mixtures are not interpretable
- \* Limited samples can yield incomplete profiles

## FOUR STEPS TO DNA ANALYSIS

### ⇒Extraction

- ◇ Chemicals are used to break apart the cells and isolate the DNA within a liquid buffer
- ◇ When sperm cells are present, different chemicals are added at various times in order to separate out the sperm cells from non-sperm cells

### ⇒Quantification

- ◇ The amount of DNA present is determined for each sample which is critical for the next step
- ◇ Having the correct amount of DNA is critical to the final outcome
  - Too little or too much can result in inadequate results

### ⇒Amplification

- ◇ Millions of copies are made of specific locations on the DNA through a process called polymerase chain reaction (PCR)
  - Because of this step, small quantities of DNA can produce results
- ◇ Fluorescent tags are incorporated within the copies of DNA during PCR

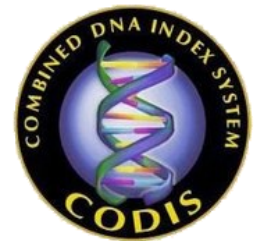
### ⇒Characterization

- ◇ A genetic analyzer is used to detect the fluorescent tags
- ◇ The data is put into a graph called an electropherogram that is evaluated by the DNA interpretation analyst

The **Combined DNA Index System (CODIS)** is a nationwide database administered by the FBI. It is used for linking serial crimes and unsolved cases with repeat offenders & qualifying arrestees. CODIS was launched in October 1998 and now electronically links all 50 states plus 2 federal laboratories and Puerto Rico. Federal guidelines regulate what samples are qualified for entry into CODIS. Forensic unknown samples must be linked to a crime in order to be eligible for CODIS entry.

**Within Arizona** there are seven CODIS laboratories. They include the Phoenix PD Crime Lab, Mesa PD Crime Lab, Tucson PD Crime Lab, Scottsdale PD Crime Lab and three DPS laboratories (Phoenix, Tucson, and Flagstaff).

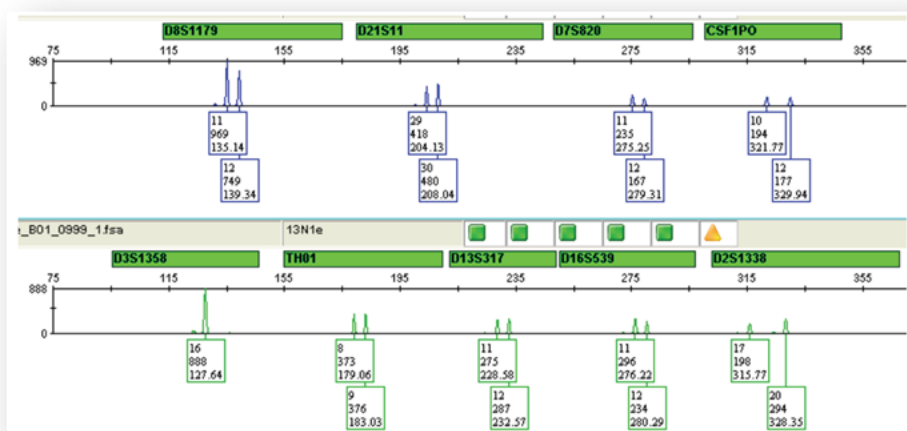
**For more information** and statistics visit: <https://www.fbi.gov/services/laboratory/biometric-analysis/codis>



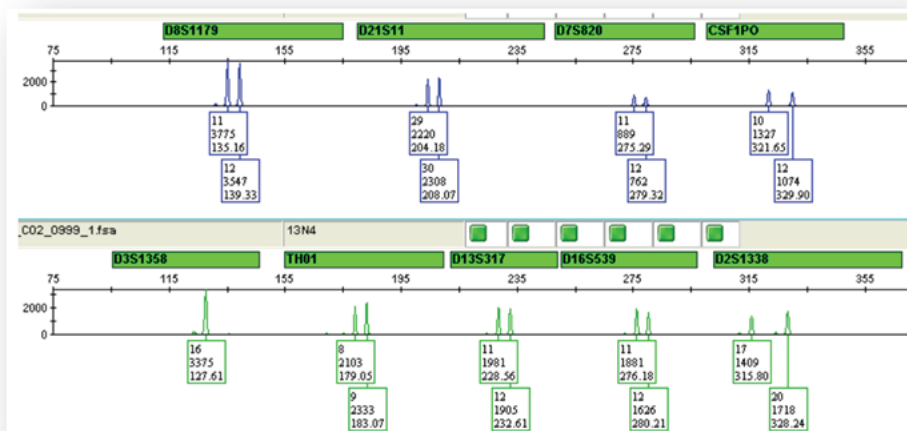
## HOW IS DNA USED IN FORENSICS?

The DNA process targets specific regions of DNA known as short tandem repeats (STRs), where individuals are known to differ. Analysts are looking at specific areas of DNA that are repeat sequences and do not code for anything. This means that analysts cannot determine traits such as ethnicity, height, hair color, or health risks from these areas of DNA. They are able to make comparisons between profiles developed from unknown evidence samples and reference profiles from known samples.

### Unknown Evidence



### Known Reference Sample



The Forensic DNA Section also utilizes Y chromosomal testing that targets short tandem repeats on the Y chromosome (YSTRs). Because only males have a Y chromosome, female DNA does not interfere with Y chromosomal testing. Unlike STR testing, YSTRs are not unique to each individual. YSTRs are paternally inherited and all paternally related males will have the same YSTR profile.

