



# Solutions

Issue No. sol-044

 Genetic Identification

 Forensics

 Environmental

 Petroleum/Industrial

 Food Safety

 Value Added Services

## DNA Information Sheet

### What is DNA?

DNA stands for “Deoxyribonucleic Acid”. There are two types of DNA:

- ◆ Nuclear DNA
- ◆ Mitochondrial DNA.

Nuclear DNA is found in most cells in a person’s body and is inherited from both parents. It has been described as the “Chemical Blueprint” that codes for all living organisms.

Mitochondrial DNA is found elsewhere in the cell and is inherited from only the mother.

The majority of forensic casework involves the analysis of nuclear DNA. Mitochondrial DNA analysis is generally considered when nuclear DNA analysis has been unsuccessful or when a sample is very old and/or degraded.

### The Nuclear DNA Molecule

The DNA molecule looks like a long, twisted zipper. Each tooth in the zipper is made from one of four building blocks called “**bases**” which fit together in a specific pair-wise fashion. Each human cell contains 3 billion base pairs. The sequence of the bases is what constitutes the code for an organism.

In forensic biology, we analyze a small fraction of the nuclear DNA molecule. These areas, or loci, are referred to as STRs which stands for “Short Tandem Repeats”. Among individuals the length of the DNA molecule may vary at the STR loci. Depending on the number of STR loci analyzed, no two individuals have the same DNA profile except for identical siblings. Within an individual, the STRs will be the same regardless of what sample (ie. hair root, blood, skin cells, etc.) is analyzed at these specific loci.

Analysis of the standard 13 STR loci used in forensic casework does not give any information about an individual’s race or health status.

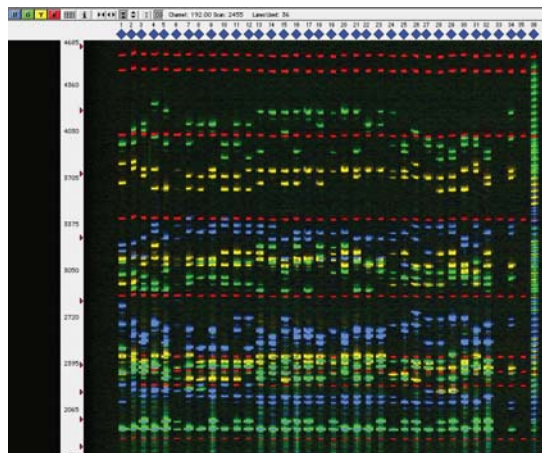
### Advantages of DNA analysis

#### Stability:

- ◆ DNA is stable for many years if stored dry and at cool temperatures.

#### Sensitivity:

- ◆ Minimal amounts of cellular material are needed to generate a DNA profile. For example, 40 – 50 cells on a licked stamp can yield a complete DNA profile.



Please turn over for:

How we Perform DNA Analysis, How DNA is used in forensic casework, CODIS and the National Data Bank, Web Resources, Contact Us

## How we Perform DNA Analysis

We use technology called Polymerase Chain Reaction (PCR) which chemically photocopies (amplifies) a number of STR loci simultaneously.

Once the different lengths (fragments) of DNA have been amplified at each of the STR loci these fragments can be separated out on the basis of their size by a process called electrophoresis. The separated DNA fragments can be visualized with the assistance of a computer. The resulting DNA profile looks very similar to a UPS barcode where each STR fragment is represented by a band in the barcode.

## How DNA is used in forensic casework

In forensic casework, usually the first step is to identify a body fluid stain such as blood, semen or saliva or to find hairs or skin tissue on an item. Once this is accomplished, the second step is to try to determine who could be the source of the material. DNA analysis will determine whether a stain/substance is human in origin, from a male or female and allows for potential identification.

DNA testing is highly discriminating:

- ◆ Population databases are used to estimate how common a profile is in the population. It has been estimated that the most commonly occurring profiles in a given population are in the range of one in millions to one in billions.

The pattern of bands (DNA profile) can be compared between a questioned sample and a comparison sample (see below) from a known individual. If the comparison profile from the known individual differs from the questioned profile, the known individual cannot be the source of the body fluid stain. If the comparison profile is identical to the profile from the questioned sample, the known individual may be the source of the body fluid stain.

Comparison samples from known individuals can be:

- ◆ Consensual or ordered by judge's warrant (i.e. blood from a finger prick, saliva samples or pulled head hairs)
- ◆ Discard (i.e., cigarette butts, used tissue paper, chewed gum, licked stamps or envelopes, drinking cups, eating utensils, straws, razors, tooth brushes, etc).

**For more information about how we can help you with your forensic investigations and the services we offer, or to schedule an informational session at your location,**

**please contact us:**

Call toll-free from anywhere  
in North America  
1-877-706-7678

## CODIS and the National DNA Data Bank

DNA profiles submitted to the National DNA Data Bank of Canada are organized in two general indices:

- ◆ Crime Scene Index
  - Profiles generated from crime scenes that are believed to be from perpetrators. No DNA profiles from comparison samples are entered into this index.
- ◆ Convicted Offender Index
  - Profiles generated from all offenders convicted of a primary designated offense, and at the discretion of a judge, those convicted of a secondary offense.

Within the National DNA Data Bank of Canada, the crime scene profiles and convicted offender profiles are compared to determine whether crime scenes can be linked together and whether crime scenes can be linked to known convicted offenders.

The software used by the National DNA Data Bank is called CODIS and stands for the "Combined DNA Indexing System". This software is used in numerous countries including the United States.

## Web Resources

Canada's DNA Data Bank

<http://www.nddb-bndg.org>

The DNA Identification Act of Canada

<http://laws.justice.gc.ca/en/D-3.8/index.html>

The Federal Bureau of Investigation Laboratory Division

<http://www.fbi.gov/hq/lab/labhome.htm>

DNA Links

<http://www.law-forensic.com/dnainlinks.htm>

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