

Summary Respecting Current DNA Analysis

1. Two fundamental aspects about the form of DNA are that it is packaged in the form of a double-stranded twist (or helix and that is made up of base pairs that connect in a specific ways, with the sequence of the base pairs running in opposite directions.
2. **DNA is the basic molecule** that contains the blueprint for the life of virtually all living organisms. The nucleus is the cellular compartment within which twenty-three pairs of chromosomes collectively hold the complete genetic information about a person. This total blueprint is called the human **genome**. For that reason, it is commonly referred to as “genomic DNA”.
3. The base pairs compose an “alphabet” of only four letters. Depending upon their arrangement, they can create an infinite number of distinct individuals. Each “letter” of the “alphabet” only lines up opposite its complimentary letter of the alphabet. These letters are referred to as A.C.T. & G. “A” is for “adenine”, “C” for cytosine, “G” for guanine and “T” for thymine.
4. Scientists look at fragments of DNA base pairs (referred to as **alleles**) in specific areas of interest, on specific chromosomes, for their size. Scientists commonly refer to such areas (or **loci**) as “**highly polymorphic**”, which means areas that vary greatly in size between individuals.
5. Today, these fragments are called “**STRs**”, an acronym for **Short Tandem Repeats**.. STR’s are short fragments of variably repeated base pairs in certain sequences that code for nothing. A forensic DNA **profile** represents the sizes of STR’s determined to exist at several independent loci. As noted above, scientists examine fragments of DNA at these loci on specific chromosomes to determine their size.
6. The DNA blueprint in each cell is the same, regardless of its location on the body. No two people have the same DNA except identical twins.
7. The forensic application of DNA analysis began in Canada at the Central Forensic Laboratory of the R.C.M.P. in Ottawa in the fall of 1989. The method now widely used in casework is based on an amplification procedure called Polymerase Chain Reaction (**PCR**).
8. At present, two forms of PCR-based DNA analysis are used in the R.C.M.P. labs (and, for that matter, throughout much of the world). They are called “**Profiler Plus**” and “**Co-Filer**”. Profiler Plus looks for 9 areas of interest plus the gender of the individual, while CoFiler (the primary analysis used by national DNA data banks) looks at 7 areas of interest, plus the sex identifiers. Three loci between the 2 tests are the same. Used forensically, it is therefore possible to combine the two tests to look for 13 different loci from which to discern a DNA profile.

9. Based on scientifically validated data bases, scientists are able to estimate the rarity of DNA profiles. In Canada, the Reporting Scientist's (**RS**) formal report states an estimate of rarity of a profile based on a Caucasian data base only, but estimates based on other racial data bases are also available. The reason the Caucasian data base is used as the norm is that, in most instances, Caucasians likely make up the majority of the population in the general area where the crime was committed and from which the perpetrator could have come.
10. **Forensic DNA analysis** compares the DNA profiles from an unknown human biological substance found at a crime scene to the DNA from a known individual. The more loci that compose the profile, the more the profile can be distinguished from any other. If the profiles **match**, the scientist determines how rare the profile is so that a conclusion can be reasonably arrived at as to the source of the unknown DNA.
11. An estimate of the likelihood of a matching DNA profile coming from some other, unrelated individual in a given population is expressed by a number called the **Random Match Probability**. The RMP is a numerical estimate of rarity of a DNA profile in a given racial population. Often, the estimates of rarity are often so high that they eclipse completely the number of people of a given race or even the world's population.
12. Like fingerprints, DNA analysis is just one piece of circumstantial evidence whose probative force will almost always depend on the surrounding evidence. DNA analysis eliminates a great many people from police suspicion. The forensic scientist is essentially always trying to distinguish one sample from another. When the samples cannot be distinguished, they match. This is termed an "**inclusion**". Should there not be a match at all loci, the result is termed an "**exclusion**", and the suspect is eliminated. When, on the evidence one cannot conclude one way or the other, the result is logically said to be "**inconclusive**".