

EPIGENETIC MARKERS: A FORENSIC TOOL FOR THE DETERMINATION OF BIOFLUIDS PRESENT AT SEXUAL ASSUALTS AND OTHER CRIME SCENES

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Oftentimes in forensic cases, knowledge of the originating source of biological stains found at crime scenes is required. Although certain chemical and microscopic tests exist to specify blood, semen and saliva, they are mainly presumptive with varying sensitivity and specificity. Therefore, the development of a method to specifically identify the tissue type of a DNA source is imperative.

Epigenetic modification of mammalian DNA is a naturally occurring mechanism crucial for the function of the genome and its transcriptional regulation. Although the DNA sequence in each individual cell is identical, its epigenetic profile is not. Epigenetic modifications include methylation at CpG islands and histone deacetylation. These modifications play a role in regulating the transcription and expression of genes allowing cells to differentiate into functionally and metabolically specialized cell types. The study of epigenetics as a useful tool in forensic tissue identification has proven to be promising. In the current study, we present a set of epigenetic markers found to be differentially methylated in four common bio-fluids found at crime scenes: saliva, blood, sperm and epithelial cells.

After PCR amplification, any methylation information is lost. It is therefore necessary to subject DNA to bisulfite conversion, a chemical treatment that converts all unmethylated cytosine bases in the DNA to uracil and subsequently thymine bases during PCR.

Saliva, blood, semen and epithelial (skin) cell samples are first taken from a minimum of 10 individuals. DNA is extracted and the entire genome is subjected to bisulfite conversion. Modified DNA is PCR amplified at specific loci and the resulting products are pyrosequenced using a Pyromark (Qiagen) sequencer. Pyrograms are then analyzed for methylation pattern differences between the four cell types and between individuals. Using this method, epigenetic markers have been identified to differentiate each of the four biofluids listed above. The results of this study indicate the potential of a novel tool in identifying biofluids found at crime scenes.