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Short Review Paper

Comparative role of serology and DNA profiling in forensics

Puri A.C.
Regional Forensic Science Laboratory, Indore-452001, M.P., India
avinash_puri@hotmail.com

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Abstract

Forensic serology and DNA profiling are extremely important branches of forensic science. Forensic serology has been a major area of forensic science biology for many decades. Forensic serology is mainly related with the identification of biological evidence. DNA as a newer technology in forensic science evidence examination is the most beneficial and an important part as compared to the forensic serology division. In the biology laboratory, forensic biologists performs mainly serological and DNA analysis of fluids. Forensic techniques for DNA profiling which being developing around 1985 have replaced the classical or traditional genetic system previously used such that forensic serology. DNA typing can help to bring home the guilt, acquit the innocent those wrongly convicted. In this article we'll review two techniques of forensic science which are the basis of forensic serology and DNA typing as important forensic evidence. Apart from all available techniques DNA profiling for evidence easily give the result. DNA profiling is specially used against serious crime and criminals. The recent advancements of DNA technologies are certainly helpful in the conviction. DNA analysis is the most effective way to solve any case easily. When any crime is occurring, people can leave evidence at the crime scene and they leave a trace such as biological materials that contain DNA. As compose to serology and biology examination of all body fluids and other relative evidence examination are tough because of the evidence isolation and preserved but in DNA profiling, all preserving integrity of DNA for a long period and storage of DNA becomes easy. Apart from all available techniques DNA profiling for evidence easily give the result. DNA profiling is used in most of the cases nowadays to solve serious crime offences.

Keywords: Forensic science, serology, deoxyribonucleic acid.

Introduction

In the forensic science, many forensic scientists deal with the main two major divisions that is serology and DNA division because each division is related to forensic biology. Forensic biology described the all-body enzymes, body fluids etc. In most of the crime scene biological fluids related evidences are mainly found. Now a days serology and DNA analyses are closely related to each other because of the better performance and result.

In many forensic laboratories, they are considered within the same division. Serology means analysis of biological fluid evidence such as serum, saliva and most important blood, semen, urine and vomits etc, these body fluids are mainly found during heinous crimes such as murder, rape, sexual assaults etc, whereas "DNA analysis" helps in establish to individualize physiological fluids to a specific person. In most of the forensic biological samples, before DNA analysis, identification of serological fluids is necessary. Forensic scientist examined both serology or DNA techniques. Serology is considered as one of the oldest forensic techniques and it is remained unchanged, whereas DNA techniques and its applications are continuing changing or developing day by day and considered as one of the best detection technique. In serology, Examination is done by old methodology, instruments and technique but in DNA profiling examination is done by new methods and newer technologies.

DNA is the basic unit of life in the cell. Raw materials in cells such as, carbohydrates, amino acids, lipids and micro elements are received and new substances like nucleic acids, proteins, carbohydrates are produced and wastes are removed. In other words we can say that, DNA is our genetic blueprint because it helps in stores the necessary information for genetic attributes in every cell of our body. The DNA technology in forensic evidence examination is the most beneficial and an important part as compared to the forensic serology division[1-6].

Evidence at the scene of crime: serological/DNA

The correct identification of criminals and other individuals has always been one of the most important part in criminal and civil investigations, to solve any criminal cases, forensic experts as well as investigation officers (IO) search the biological evidence at the crime spot. The investigation officers should be collected all evidences on the bases standard operating procedures (SOP). Those evidence on which biological fluids are thought to be found at the crime scene, the investigation officers collected that exhibits for submitted to forensic science laboratories in

forensic serology and DNA division for further analysis. Basically, in serology and DNA, mainly cases involve in murder, rape, and sexual assaults etc. Exhibits commonly include the following items i.e., bedding and bed sheets, clothing's etc and the other important areas where the forensic serology and DNA division related evidences are found for that submissions include the most valuable potential blood evidence from murder, sexual assaults etc.

The above mention following cases exhibits commonly investigated for the presence of blood include swabbing and scrapping from crime spot, weapons and clothing and any number of other exhibits that may contain patterns of bloodstains. If at the crime spot, the small size of biological evidences is found, at that time, evidence can be submitted to the forensic laboratory in its totality and for major size of evidences, the investigation officers collected the stains with the help of sterile swab of cotton or a cutting from the exhibits can be sent to forensic analysis.

If the investigative officers must be following the standard operating procedures (SOP), ones should collect exhibits from mouth, e.g., cigarette buts, chewing gum, glass, lipsticks, cans, mugs, bottles, candy and toothbrushes etc and these exhibits mainly provide enough DNA examination to establish profile between offender or criminal.

In some of the cases, normally touched objects i.e. a car steering wheel, weapon, mobile or analysis of biological evidence for that particular case but sometimes not gives profile of DNA, because the required quantity of biological evidence not contains proper DNA which is required for analysis[7].

DNA examination is successfully done when the proper sample are available, for that region fluids such as saliva and blood is considered as a referral sample. Blood is normally collected from the vein and properly stored in a EDTA vial (vacutainer). After the blood collection with the help of FTA card, blood (dried) samples can be stored and stabled for several years even at room temperature.

The most important evidence in DNA examination is saliva and it can be collected mainly by chewing the gauze piece and by collecting saliva on to a collection card, or with the help of swabbing of a person's cheeks inside portion of buccal to collect epithelial cells. In some crime scene traces evidence are found for examination of DNA analysis which is hair. Hairs can be used as a standard sample. From deceased sample can be in the form of tissue, blood or bone which depends on the state of decomposition of the remaining samples and analysis is done quite easy.

Examination of Biological Evidence: Current prospective of DNA Profiling

Forensic biology is a science which helps in crime investigation. DNA plays very pivotal role in to link a suspect to a crime. If any crime is occurred, the suspect always leaves a trace, and then the forensic investigator identifies the crime scene. After collection of all evidences, investigation officers referred to the exhibit in the laboratory. Then the forensic expert continues working on that particular evidence on the basis of investigation officers requested. The important part in lab is to screen exhibits in an effective manner.

In general manner, transfer of biological fluids in a corroborative samples and in that samples DNA is found in suspect's or victims serological fluid or clothing, which is the prime factor of evidentiary values. The most common types of case such as murder and sexual assault etc. In this type of cases, the most important biological evidence is semen. In some sexual violence cases, the presence of semen is key point to support the evidence of a victim's assault. If semen is found on clothes, its presence on victim clothing's, for a long time whereas the evidence of seminal stains on clothes can present longer duration.

Normally, evidence of biological samples first goes through serological screening. However, traces amount of DNA evidence found in many cases that do not benefit from serology screening. DNA analysis helps in the alleged father to establish or disprove parentage. It is not necessary to have a standard sample from the mother or complainant for parentage, having the DNA profiles of the off spring and both parents facilitate DNA interpretation[8-10].

Evidence Examination

Evidence examination, analysis and identification are the most crucial part of forensic science. As we know, forensic serology methods are relatively easy to handle and straight forward. Serology experts deals with the properties and features of different types of biological fluids (serum, saliva etc) for identification.

In serology, analysis of biological fluids is depends on both presumptive and confirmatory testing which is sensitive, specific and faster. The time of confirmatory testing is required much longer than presumptive testing. DNA examination is a confirmatory test because of it's reliability, species, although not biological fluid, mainly for human DNA[11]. Here we mention the biological evidence examination with the help of steps of DNA profiling: i. DNA Extraction Method, ii. Differential DNA Extraction, iii. DNA Quantification, iv. Human-Specific DNA Quantification, v. Real-Time Polymerase Chain Reaction Quantification, vi. Short tandem repeats, vii. Mt. DNA sequencing, viii. Y-Chromosome STR, ix. SNP Analysis, x. CODIS Database.

Conclusion

The new technologies and scientific advancements and development in the field of DNA are certainly playing a huge impact in capturing and most convicting the criminals. Forensic

DNA profiling is used in the criminal justice system. DNA analysis is most effective way to solve any case easily. When any crime is occurring, people can leave evidence at the crime scene and they leave a trace such as biological materials that contain DNA[2].

DNA recovered from stains of saliva, blood, semen, skin, bone and hair can be matched to the DNA of a suspect. Thus, all forensic science laboratories nowadays use DNA technique to easily solve the crime. Today, the general public is familiar with the fact that newer DNA techniques like touch DNA are being used[12]. However, newer technologies are regularly introduced and validated by experts to expand the capabilities of laboratories working because of easy to recover DNA results with improved sensitivity and reliability[13-16]. As compose to serology and biology examination of all body fluids and other relative evidence examination are tough because of the evidence isolation and preserved but in DNA profiling, all preserving integrity of DNA for a long period and storage of DNA becomes easy[17-19]. Apart from all available techniques DNA profiling for evidence easily give the result. DNA typing plays very important role in judiciary system by helping to convict serious criminals.

Abbreviations: DNA-Deoxyribonucleic acid, SOP- Standard Operating Procedure, IO-Investigation Officer, STR-Short Tandem Repeats, SNP-Single nucleotide polymorphism, CODIS-Combined DNA index system.

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