

Forensic Biotechnology: Application of Flow Cytometry in Legal Medicine

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Mini Review

Volume 1 Issue 1

Received Date: July 12, 2016

Published Date: July 15, 2016

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Introduction

Precision in experiment is one of the most important parameter in the field of Science. To obtain the precise result sophisticated instrumentations are required. In the field of forensic science, a forensic scientist must be proficient in assimilating knowledge and skills to examine, analyze, interpret, reporting, and give expert opinion in support of evidence. These aforementioned skills can work only when examination will perform with precision. Nowadays, in criminal investigations forensic experts are using biotechnology based methods for sample analysis. Basically, Forensic investigation is the application of scientific tools and specific scientific facts that can help to solve the legal problems. The best example of application of biotechnology in Forensic science is DNA Forensic. This branch of forensic science is now transforming many aspects of criminal investigation. By the help of biotechnology methods, analysis of DNA samples allows precise identifications to be made from very minute evidence collected at the scene of crime. This application of biotechnology in forensic investigation emerged a new branch of forensic science known as "Forensic Biotechnology". Typically, forensic biotechnology is linked with DNA fingerprinting. By identifying DNA recovered from the biological evidences such as biological fluids, hair or tissues collected at the scene of crime, a forensic biotechnologist can link to a suspect to the crime scene or identify an unknown individual. Another application of forensic biotechnology is its use to identify and monitor non-human organisms, such as endangered species, through DNA fingerprinting.

Application of Flow Cytometry in Forensic Medicine

Apart from DNA fingerprinting nowadays forensic biotechnology is in demand in the field of Forensic Medicine. Estimation of the postmortem interval (PMI) is one of the most essential and recurrent issues in forensic investigation. There are several studies precisely and systematically estimating the PMI and examination of external physical characteristics of the body, internal body temperature, stomach contents, and chemical and biochemical changes of body fluids or tissue. Among all of them, DNA degradation and vitreous humour (VH) had well studied, which provided good results with preciseness, reliability and rapid estimation of PMI. Williams et al 2015 have analyzed the correlation between the rate of DNA degradation and PMI using flow cytometry. In this study the rate of DNA degradation of spleen and brain tissues were observed over a period of 96 hr at two different temperature conditions (21°C and 4°C), to mimic summer and winter climate, respectively. The results from this study revealed that brain can be an organ of choice for PMI studies through DNA degradation as compared to spleen.

Vitreous Humour is another reliable source through which PMI can be estimated. Many studies have been done in which vitreous humour used for PMI estimation. However, study related to contamination and interference in VH is still lacking and leads the erroneous estimation of PMI. Therefore, to eliminate the error caused by presence of RBC, WBC and other non VH cells and biomolecules an attempt was made to introduce a flow cytometry based

method. Flow cytometry is a technology that is used to analyse the multiple characteristics of single cells. Characteristics that can be measured include cell size, cytoplasmic complexity, DNA or RNA content, and a wide range of membrane-bound and intracellular proteins. To estimate the PMI, Corderio et al 2015 demonstrates the capability of flow cytometric based method that can be able to detect erythrocytes in 1:750,000 dilution of contaminated VH and allows screening of samples for which the biochemical results would be unreliable. Due to this reason, flow cytometry based screening test become the method of choice for the demonstration the hematic contamination of VH in estimating precise PMI. Because the sensitivity of flow cytometry is greater than the previously used method, it becomes more accurate, rapid and sensitive method for estimation of PMI through the VH.

Conclusion

Advent of these biotechnology based screening methods specify towards more precise forensic examination which would be helpful to avoid the false interpretation and reduce the number of pending cases in the court. Many more biotechnology methods may also helpful to combat the crime by their applications; the only thing is more in-depth research would be needed.

References

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