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Commentary

Recognition of DNA Databases for Criminal Investigation and their Scientific Implications

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DESCRIPTION

By establishing a connection between sample donors and actual criminal activities, the kind and origin of the human fluids recovered at a crime scene might provide crucial information for crime scene reconstruction. Since more than a century ago, several other kinds of body fluid identification techniques have been created, including chemical testing, immunological tests, and tests of protein catalytic activity, spectroscopic techniques, and microscopy. However, only one bodily fluid may be identified at a time using these traditional approaches, which are mostly based on assumptions. Therefore, RNA profiles or DNA methylation detection utilizing a molecular genetics-based methodology has recently been suggested to replace traditional body fluid identification techniques.

On sterile cotton swabs, the bodily fluid samples were obtained, dried, and stored at room temperature. Blood was drawn *via* venipuncture without the use of anticoagulants, and 50 µl aliquots were spotted onto sterile cotton swabs. Menstrual blood and semen-free vaginal secretions were drawn from the vagina using sterile cotton swabs, which were then allowed to air dry at room temperature. In sealed plastic cups, freshly ejaculated semen samples were given, and they were dried onto sterile cotton swabs.

The specificities and sensitivities of many RNA markers and tDMRs (tissue-specific differentially methylated regions), which are specific to forensically important body fluids, have been examined using a variety of samples. In this study, we give a general overview of current knowledge and the most recent advancements in forensic bodily fluid identification and describe how they might be used in actual forensic cases.

Forensic investigators consider body fluid traces to be one of the most crucial pieces of evidence. They contain priceless DNA evidence that can be used to identify a suspect, victim, or exonerate an innocent person. Since the nature of a particular body fluid can be extremely instructive to the research, the initial step in identifying it is crucial. Additionally, when just a little amount of material is available, the destructive character of a screening test must be taken into account. Another crucial milestone in the evolution of forensic body fluid analysis is the capability to define an unidentified stain right at the scene of the crime without having to wait for laboratory results.

For crime scene reconstruction, it's critical to determine the source of body fluids that have been left behind. However, traditional serology-based methods for body fluid identification are susceptible to a number of drawbacks, including sample consumption, intensive labor, time consumption, and varying levels of sensitivity and specificity. Numerous messenger RNA (mRNA) markers are tissue-specific in their expression, and under controlled circumstances, their patterns of expression can reliably identify particular bodily fluids even after extended periods of time. However, mRNA stability as a particular and sensitive biomarker for forensic applications is negatively impacted by humidity, heat, UV light, and common ribonucleases.

Body fluid identification techniques have undergone substantial development in recent years, driven by their significance for forensic applications. For forensic investigators to continuously learn about new advances and potentially better methods, a thorough analysis of these new discoveries is essential. Over the past ten years, significant advancements in laser technology and the creation of innovative light detectors have significantly improved spectroscopic techniques for molecular characterization. The use of this cutting-edge bio spectroscopy in forensic investigations creates innovative and exciting potential for the creation of on-the-spot, non-destructive, confirmatory techniques for body fluid identification at crime scenes. In addition, unlike most present procedures, which are only valid for certain fluids, bio spectroscopy approaches are generally applicable to all body fluids. It examines the ways now in use to distinguish between body fluid stains including blood, semen, saliva, vaginal fluid, urine, and sweat, and it also focuses on fresh methods that have emerged in the recent five to six years. A body fluid's potential for quick, confirmatory, non-destructive identification at a crime scene. To determine the criminal character of an incident in forensic casework, particularly in

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situations of sexual assault and child sexual abuse, it is necessary to validate the provenance of the DNA as well as identify the DNA profile. How to identify body fluids quickly and accurately while using a reliable biomarker is one of the issues facing the forensic community. Conventional serology-based procedures for body fluid identification are prone to many constraints, such as sample consumption, heavy labor, time consumption, varied degrees of sensitivity and specificity, and no conclusive tests for the presence of menstrual blood and vaginal secretions.

CONCLUSION

Numerous studies have shown that mRNAs express differently in different tissues and that, even after prolonged periods of time under controlled conditions, their patterns of expression can corroborate the presence of particular bodily fluids. However, mRNA stability as a precise and sensitive biomarker for forensic applications is adversely affected by heat, humidity, UV light, and common ribonucleases.