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Importance and Role of Physical Evidences in Forensic Science

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Abstract:

Forensic Science has seen tremendous transition through the ages and has emerged as an undetectable and integral part of the criminal justice system. There has been more and more dependence on this field and has led to the successful conviction of in large number of crooked criminal cases. There has been a communication gap in understanding the concept and the potential value of physical evidences starting from the fingerprints to DNA evidences. An attempt has been made to introduce the value of neglected physical evidences like traces of plant material, soil, and micro organisms. The challenges to DNA evidence posed in the form of full siblings have been explained and it is believed that still DNA profiling stands one of the most reliable forensic evidence at the crime scene, both in plants and animals, linking crime to the criminal.

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Introduction

Organism, starting from less evolved to highly developed like human being, live in a specific environment and as such, are modified accordingly with the external environmental stimuli. The behavior of an organism is dependent on the developmental stage of nervous system of the organism. More developed the nervous system, more phenotypic plasticity the organism will show and hence more complex the behavior of the organism will be. Despite being at the top of behavioral evolution, human beings like other organisms, have certain basic characteristics which are expressed under ambient external stimuli. These characters are not under the direct control of the individual, rather controlled by Autonomous Nervous System. For example, a person experiences extreme urination during stress, the heart rate escalates upon reading a sad news, etc. Similarly, human beings are evolved through ages with certain conserved basic characters which define the personality and moral character of the person. A person is born with these characters and ungrudgingly intends to cherish and follow these set of rules. **Satisfaction**, fulfillment of one's wishes and desires, is one of such characters that is the end result, the individual is fighting for. A person climbs a peak for some inner satisfaction, other person works the whole day with an expectation of receiving some gain at the end of the day, which brings him satisfaction. This tendency is not limited to humans only but extends to other animals also. A dog comes up with strong resentment upon seeing an infiltrator claiming his territory in a specific area and after giving infiltrator, a successful bid, feels highly satisfied. Therefore, it can be claimed that every individual intends to progress towards attaining greater and greater satisfaction levels. Whenever some hurdle comes in the way of the progress of attainment, it is attempted to be removed whether legally or illegally. These hurdles may be in the form of deprivation of wealth, property, gaining supremacy, avoiding competition, avoiding disturbances in personnel life, etc. Attaining satisfaction through these material factors may force the person to opt for legal as well as illegal ways/methods. Any factor which comes in between an individual and his objective of satisfaction can be met with serious consequences. Therefore, an individual opting for illegal ways of attaining satisfaction is said to have committed a crime. This is a deviation from the normal behavior of an individual and is termed as **Psychological disorder**. The concept that a psychological disorder will intern produce various signs, are actually the basis of various techniques of crime detection.

Similarly, another character that is inherent within the humans is to speak truth. A person who refrains from this inherent act and opts for an alternative by speaking a lie, is said to deviate from the normal behavior and is again noticed in the form of a psychological disorder producing various signs. In order to counter these psychological disorders, a person tries to develop some artificial behavior and this artificial behavior is observed in the form of various fluctuations in physiological parameters like blood pressure, heart rate, precipitation rates, secretion of saliva, dilation of pupil, etc., through the secretion of **epinephrine** of adrenal gland. However, the professional criminals and habitual liars are a serious drawback to this theory because they do not develop guilt as a result of extreme modification in their basic belief system and fundamentals through modified religious teachings, negative cognitive bias modification through cast, colour, etc. If there are certain mechanisms to detect these physiological changes, the perpetrator of the crime can be detected.

One more character, **Uniqueness** is considered as the most important factor in crime investigation. The admissibility of the eyewitness is based on the principal of uniqueness. Believing that every entity has some factor of uniqueness attached with it, is actually exploited in the courts. A person is unique believing that his fingerprints, skin colour, hair, eyes, blood group, etc. are unique to him with different degrees of uniqueness attached with them. The admissibility of eyewitness in the court of law as primary evidence has however been challenged at various levels like; challenging the vision, challenging the memory, challenging the psychology, optical illusion, threats and fears, intentional deception, etc. therefore, moving forward all these factors need to be given due weightage. The evidences are of two types; **Direct** and **Indirect.** The direct evidences can be in the form of eye witnesses or the evidence provided during dying declaration. Indirect evidences or circumstantial evidences can be of further two types as; **Subjective** and **Objective.**

i. **Subjective Evidence:** This type of evidence is based upon the personnel knowledge and expertise of an expert and can vary in accordance with the experience of the expert. If a person experiences certain disorder and consults a normal medical practitioner who has recently joined the profession. The doctor will, without doubt, advice certain precautions in diet and will put him on strict medication for a certain period. If the same patient goes for a successive consultation to a senior doctor and explains him about all the complicacies faced. The doctor, having seen a large number of such cases, will console the patient and conclude the disorder as a normal process of ageing and refrains from any dietary precaution and no medication. Both the doctors are correct, but have given the evidence as per their knowledge and expertise, are their respective subjective evidences. Similarly, if we have an apple with a black spot on it, one person shall conclude it as a rotten apple and advise eating it should be avoided. Some other person shall conclude that there is nothing bad in it and the apple is fit to be eaten. Upon giving the opening both the persons shall use the words "according to me" the apple is fit or unfit for eating. This is also a subjective evidence of the two persons.

ii. **Objective Evidence:** If the black spotted apple, in the above quoted example, is subjected to various analytical methods like ascertaining the content of water available, sugar concentration and quality, presence of vitamins and minerals and their content percentage, presence of harmful ingredients, then only, it can be concluded whether the apple is fit for eating or not. But, this time the analyzer (expert) shall not use the words "according to me" rather say "according to scientific procedures" (or according to set rules) the apple is either fit or unfit for eating. Similarly in the earlier case, to bring in more objectivity in the opinion a panel of expert doctors shall be called for giving the opinion and the proceedings are done under audio-visual documentation. Therefore, in order to get more reliable evidences, the subjectivity of the opinion needs to be converted in to more and more objectivity. This can be done through the use of modern scientific technology through forensic science. The more we move towards objective evidences, the more we are nearer to truth.

Crime Scene and Its Management

Any type of crime creates a crime scene, and as a forensic scientist it becomes very important to go very deep in to the nitty-gritty of the crime scene. The place of occurrence, if properly managed, is going to determine the future of a criminal case. Identifying and at the same time appreciating the value of a particular physical evidence, is probably the most important factor in crime scene investigation and further processing. Therefore, it becomes very important that the crime scene investigator or the forensic scientist must have a comprehensive knowledge and exposure to all the fields that can play a role in the justice delivery system. Now, what expertise and exposure the crime scene investigator must possess, depends primarily upon the possible nature of physical evidences present in the crime scene. The variety of physical evidences present in the crime scene intern depend on the type of the crime committed. Therefore, a sharp crime scene investigator will try to include and exclude various physical evidences, depending on the relevance and irrelevance of these evidences in a particular case. Care has to be taken that no potent physical evidence should be skipped and irrelevant and unnecessary and extravagant items are not collected to avoid false leads. An idea of all the physical evidences, whether within or outside the crime scene demarcation will play a crucial role and hence has to be documented and preserved for future analysis. In a murder case, for example, the possible physical evidences that the investigator should look for may include; weapon of offence, fingerprints on the weapon of offence or any other item which logically appears to have been touched by the perpetrator, foot prints, and types of injuries on the victim. Similarly, in a rape case the choice of physical evidences will shift a different way and depends on the perception and correlation power of the crime scene investigator. In this case the investigator will look for semen stains, touch DNA on the body parts of the victim, vaginal swaps, tissue, blood etc. underneath the nails of the victim, so on and so forth. Thus it becomes very important that the crime scene investigator be having expert knowledge of all the potent physical evidences present in the

crime scene. The physical evidences that are almost every time the integral part of every crime scene include- soil particles, plant material, micro biome, etc. The type of material, time of deposition and uniqueness is morphological and anatomical characters are to be appreciated and evaluated by the investigator and at the same time comparing with reference sample from the area will definitely give new leads to the case. These evidences will also tell us whether the scene of crime is primary or secondary in nature. Studying the morphology and anatomy of plant material or pollen grains deposited on the shoes of the victim are going to change the fate of the case exploiting the principal of uniqueness of characters at the species as well as variety level. A piece of land that has been disturbed will follow a strict pattern of re-colonization called succession. In areas like shallow grave sites, the primary colonizers are grasses followed by small shrubs and then trees. Depending upon the sun light/shade, soil conditions and water content, an estimate of time of death in these sites can be made through assessment of plant growth [1]. Estimate of time of death can also be made by forensic botany through pollen analysis [2, 3]. In an insurance fraud case, a young man damaged his hand and made a claim for insurance, for being a victim of robbery. During investigation, some grass fragments where found wrapped in a bloody newspaper. After searching the area, the location was traced where his hand was severed by comparing the plant material growing in the area with that of the plant material wrapped in the newspaper. Later on he confessed that he had used this plant material for covering his arm while getting back to his vehicle [1]. Therefore, it is immensely important that the crime scene investigator be a professional to the extent that he doesn't miss any potential physical evidence that creates a link between the crime scene and the perpetrators of crime or the victim. A person, who has lost his power of smell, cannot appreciate the fragrance of a delicious food prepared in the kitchen. In the same manner a crime scene investigator who does not have the idea of the potential and the reliability of a plant trace, or for the sake of discussion, any other material in and around the crime scene, seldom does he try to document and preserve the trace evidences and hence miss out the chance to link crime with the criminal.

Challenges to DNA Evidences

Deoxyribonucleic acid, acts as a unique bio molecule as far as its discriminatory power in concerned. This is due to its highly differential combinational potential among the nucleotides and greater stability due to inter base hydrogen bonding and base stacking interactions. This makes DNA wonderful forensic evidence which can be used even after thousands of years of preservation. A large number of cases have been solved using DNA evidence since its essence in the year 1984, by Sir Alec Jeffrey. But, there is also some serious drawback even to this highly sophisticated technique of DNA profiling. DNA admissibility has been challenged in courts questioning the genetic issues, procedural/ technical issues, result interpretation, statistics, contamination, etc. [4]. Leaving other issues aside, genetic issues in the form monozygotic identical twins and full siblings pose a serious challenge to the field [5]. As far as the siblings are concerned we know that an offspring receives two alleles, one from the biological father and the other from biological mother. Let us assume at locus **"A"** the father is heterozygous having **"7"** and **"9"** alleles while the mother being heterozygous has **"8"** and **"11".** During recombination the probability that the two children will have the same combination of alleles can be drawn using probability ratios as given in the **Fig. 1.** The probability will be generated for all the loci studied (13 in this case). Since, every event is an independent one, the cumulative effect will be given as under;

¼ + ¼ + ¼ + ¼ + ¼ + ¼ + ¼ + ¼ + ¼ + ¼ + ¼ + ¼ + ¼ = 1/6718864

That means it is possible that the two siblings have a chance of getting same alleles at one locus which is equal to one in four because there are four possible combinations at one locus of heterozygous parents. The probability will go on decreasing as we try to add more and more markers and for thirteen markers as stated above, there is a chance of repetition at all the thirteen loci by a factor of one in 6718864. It can be very difficult to prove a criminal case before the court of law as far as the full siblings are concerned but may prove to be a lead for establishing other facts.

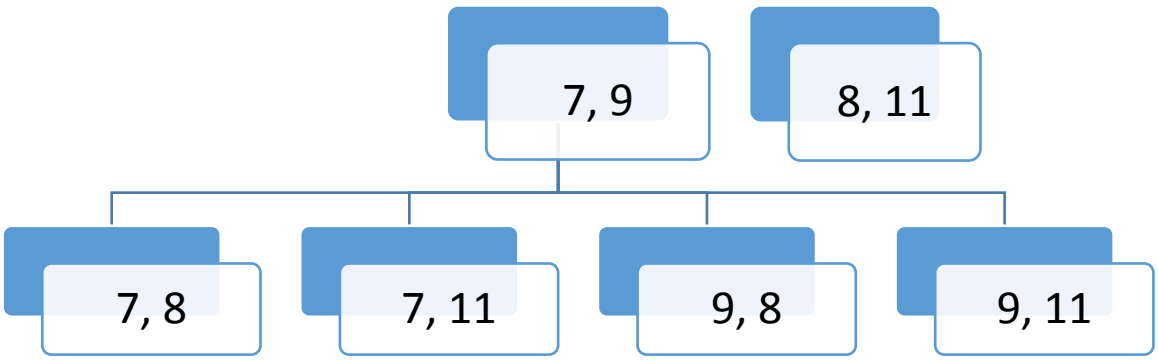

Fig. 1: in this figure the two heterozygous parents have 7, 9 (male) and 8, 11 (female) combinations. The off springs have achance of getting four different combinations as [7,8], [7,11], [9,8], [9,11] and the probability of getting a repeated combination for any of the children will be one of four at one locus. This is repeated for all the loci and as accumulative effect there is a chance of one in over 67 million.

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