

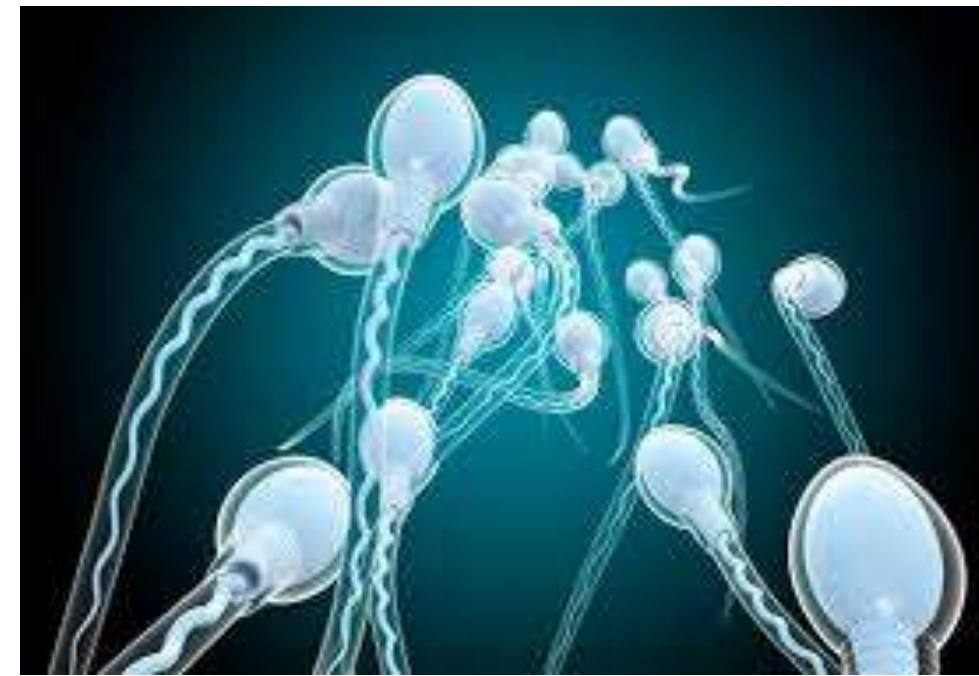
## Chapter IV: Forensic biology

### Introduction

Forensic science is the application of a broad spectrum of sciences to answer questions of interest to the legal system. Forensic science uses highly developed technologies to uncover scientific evidence in a variety of fields. It applies the knowledge of biology to identify and analyze the biological evidence obtained from the scene of a crime or from victim or suspect(s) to establish the fact that a crime has taken place. It is a broad discipline which includes various areas of specialization such as DNA analysis, forensic anthropology, forensic pathology, forensic entomology, forensic odontology, forensic botany, forensic serology, and forensic microbiology. Forensic biologists examine blood and other bodily fluids, hair, bones, insects and plant and animal remain to help identify victims and support criminal investigations. Using technology in the lab and in the field, forensic biologists collect and analyze biological evidence found on clothing, weapons and other surfaces to determine the time and cause of death. Forensic chemists, odontologists, pathologists analyze biological and non-biological trace evidence found at crime scenes in order to identify unknown materials and match samples to known substances. Working in a lab, they run tests on samples collected by investigators. Once all the evidence is analyzed, the forensic persons prepare a written report and may also testify to these findings in court.

## 1.Semen

Nature Semen is found in liquid form, smears or stains or it may be found in vagina, anus or rectum. Fresh semen is a gel like fluid, which liquefies on exposure to atmosphere. The sperm has definite morphological structure. The shape and size of human spermatozoon is characteristic. But the morphology alone does not permit individualization. Semen of a person does not contain any spermatozoon then it is called as aspermic semen. This may be due to some disease or it may be due to vasectomy operation. In such cases this criterion for the identification of semen is lost. Immunological test using anti semen sear against seminal plasma are increasingly accepted as reliable test for aspermic semen. Electrophoresis is becoming popular for identification of semen.



## 2. Saliva

Saliva stains may be found at the scene, on handkerchief, on discarded cigarette stubs, spittal, on cups, tumblers, bottles on postage stamps or envelopes or even tooth picks or they may be found on a piece of cloth used as gag. Saliva contains an enzyme (ptyalin) which when added to starch, hydrolyses it. Saliva extract, therefore, when added to starch inhibits its color reaction with iodine. Saliva of secretors contains blood group substances and can be grouped. The saliva on cigarette stubs is often in criminal investigation. DNA profiling of the saliva stains has enhanced the evidential value of the saliva stains and has brought it at par with the other body fluids like that of blood and semen. Food material mixed in saliva may interfere with blood grouping. Saliva does not give specific precipitin test.



### 3. Tears and Human Milk

Tears and human milk stains likewise permit their identification. Blood grouping of the same is possible if they have come from the secretors. DNA profile can be developed for individualization.



### 4. Hair

Hair is one of the common and important physical evidence encountered in a crime scene. Individualization of human hair i.e. whether it is from head or body. Forceful removal of hair may have blood or skin with the root. In such cases DNA typing can be done. There has been advancement in the DNA typing technology. Earlier only hair strand with root attached could be used for typing but now with advanced technology hair without root can also be used if there are enough number of hair strands.



## 5. Fingerprint

Fingerprint analysis has been used to identify suspects and solve crimes for more than 100 years, and it remains an extremely valuable tool for law enforcement. One of the most important uses for fingerprints is to help investigators link one crime scene to another involving the same person. Fingerprint identification also helps investigators to track a criminal's record, their previous arrests and convictions, to aid in sentencing, probation, parole and pardoning decisions.

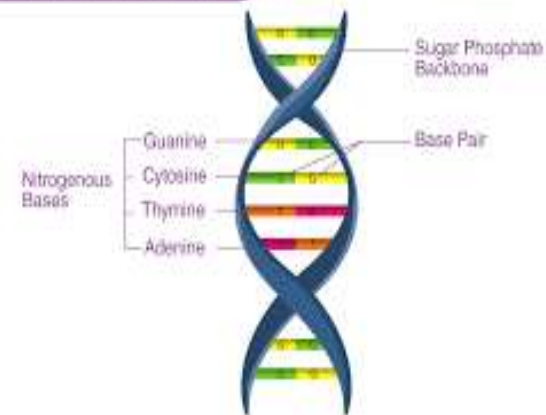


SHUTTERSTOCK

## 6. DNA

The establishment of DNA analysis within the criminal justice system in the mid-1980 revolutionized the field of forensic science. With subsequent refinement of DNA analysis methods in crime laboratories, even minute amounts of blood, saliva, semen, skin cells or other biological material may be used to develop investigative leads, link a perpetrator or victim to a crime scene, or confirm or disprove an account of the crime. Because of the accuracy and reliability of forensic DNA analysis, this evidence has also become an invaluable tool for exonerating individuals who have been wrongfully convicted.

### DNA STRUCTURE



## 7. Blood

Because blood behaves according to certain scientific principles, trained bloodstain pattern analysts can examine the blood evidence left behind and draw conclusions as to how the blood may have been shed. From what may appear to be a random distribution of bloodstains at a crime scene, analysts can categorize the stains by gathering information from spatter patterns, transfers, voids and other marks that assist investigators in recreating the sequence of events that occurred after bloodshed. This form of physical evidence requires the analyst to recognize and interpret patterns to determine how those patterns were created.

Bloodstain pattern analysis (BPA) uses principles of biology (behavior of blood), physics (cohesion, capillary action and velocity) and mathematics (geometry, distance, and angle) to assist investigators in answering questions such as:

- Where did the blood come from? - What caused the wounds? - From what direction was the victim wounded? - How were the victim(s) and perpetrator(s) positioned? - What movements were made after the bloodshed? - How many potential perpetrators were present? - Does the bloodstain evidence support or refute witness statements?

BPA provides information not only about what happened, but just as importantly, what could not have happened. This information can assist the investigator in reconstructing the crime, corroborating statements from witnesses, and including or excluding potential perpetrators from the investigation.

