

Forensic serology and its applications

[Science](#), [Biology](#)



Introduction

Biological evidences take an important role in forensic investigation or what say forensic science department. The physical evidences of biological origin which are found in the crime scene are investigated by a lot of process in forensic serology. The materials which are which are involved in forensic serology or examined in forensic serology are the body fluids like semen, saliva , blood , hair , and fibers. The biological materials like leaves, flowers, and pollen grains are examined in forensic serology. This field is generally associated with the detection of enzyme and antigens. Identification of seminal fluids or blood typing (ABO and secretor status and DNA typing) is also involved in forensic serology.

In forensic laboratory the serology section deals with all of the following:

- Typing of blood.
- Characterization of unknown or strange stains.
- Blood spatter analysis for reconstruction of crime scene.
- Paternity testing.
- Identification of semen in sexual assault cases.
- DNA typing or DNA fingerprinting for identification of victims and suspects.

How to collect body fluids

Approximately 50 ml of blood is collected and it is collected from femoral artery. In case of poisoning stomach is washed by 0. 85-0. 9 5% of saline solution. Urine is collected from urinary bladder and 100 ml urine is needed. In case of poisoning through injection some portion of skin is collected. CSF

is collected from cerebral system. If poisoning by cocaine, paracetamol, narcotics bile is collected. Due to heavy metal tissues collected from kidney. Bone and bone marrow collected from sternum and femur. In case of blood it can be originated from many sites. Like it can be menstrual blood, blood from nose, in case of blood due to rape presence of semen and pubic hair may be found. Menstrual blood and peripheral blood is distinguished by presence of D dimer.

Blood stains (Not dried): When blood is found in liquid condition it is picked up on a gauze pad or by sterile cotton cloth and then it is dried out through room temperature. It must be refrigerated and brought to the laboratory as soon as possible. If it delays beyond 48 hours it might be useless.

Dried blood stains: If blood is found in clothing's then small part of this cloth is cut and very carefully packed and leveled it without contamination. And after that it is scrubbed by scalpel in laboratory. And it can also be collected by tape lifting method.

Saliva: It is also collected by sterile gauze pad swabs, and then air dried it and packed it in a paper. And plastic containers can be used.

Seminal stains: Seminal fluids sometimes found in clothing, blankets, bed sheets. First of all air dry the stain then wrap in a paper and the collected evidence must be packed in a paper bag.

Forensic serology & its forensic applications

The study of body fluids like blood, sweat, semen, tear, saliva, fecal matter especially in regard to its immunological reactions & properties is comes under serology.

The term Forensic serology means the detection, classification and study of bodily fluids like blood, semen, saliva, fecal matter, sweat , urine which is found in the crime scene.

Serology is the heart and soul of forensic science. In a lot of cases biological fluids are found in the crime scene. And basically serology deals with body fluids. Like how to confirm a sample found in a crime scene is a body fluids or something else. The procedure of confirmation & preservation of different biological fluids are described below:

Confirmation of blood: There is a lot of process to confirm a sample is blood or not. And this are Kastle Meyer Test (phenolphthalein test), RSID Blood Test, ABA card Hematrace. The most common process is luminal test.

Luminol test: luminol is a chemical which can cover large surfaces very speedily and easily. It is non-corrosive and non-staining to sprayed articles. The luminal chemiluminescence reaction is subject to the glow of lightsticks. The criminalistics applied the reaction to detect traces of blood at crime scenes . In this test luminal powder is mixed with hydrogen per oxide and a hydroxide (e. g., KOH) in a spray bottle. The luminal solution is spread on the place where blood might be found. The iron from the haemoglobin in the blood works as a catalyst for the chemiluminescence reaction that causes

luminol to glow, so a blue glow is resulted when the solution is sprayed where there is blood. But there is a drawback of luminol test that it also can glow in sodium potassium calcium ions also.

Kastle Meyer Test: This method is an accessible, easy and reliable forensic method to detect the presence of blood. In this method firstly moisten a swab with water and touch it to a dried blood sample, don't need to rub hard or coat the swab with the sample. Then add a drop or two of 70% ethanol to the swab. Then add a drop or two of the kastle-meyer solution and have to add a drop of hydrogen peroxide solution.

ABA card Haematrace: The haematrace test is used to determine if a bloodstain is of human origin. This is an antigen-antibody reaction. The antibodies are present on the hematrace card and if the antigen (the heam group of the haemoglobin molecule) is present , then an antibody-antigen reaction occurs on the test site (T) of the card.

Semen analysis: The process to analyse a sample of semen are Acid Phosphatase Test, Christmas Tree stain, RSID Semen Test. Acid phosphatase test: The acid phosphatase reaction has now become an essential and fundamental chemical test in the hands of a forensic scientist to identify the presence of semen which is an abundant source of the enzyme acid phosphatase. This test has been successfully employed to get a proof of the presence of seminal stains.

Christmas tree test: The Christmas tree stain is a positive identification of sperm cells or presence of semen. Gradually two reagents are used to

produce this distinctive stain these are Picroindigocarmine stains and nuclear fast red. The first stain stains the neck and tail of the sperm cell in green and blue and whereas the latter one stains the sperm head and acrosomal cap with red and pink respectively.

RSID-Semen Strip test: This test provides sensitivity and specificity to human semen that is it is just only used for analysis of human semen only. It is similar to pregnancy test strip, the RSID-semen test identifies the presence of the seminal vesicle-specific antigen. This antigen is unique to semen and thus, there is no cross reactivity with other body fluids like blood, saliva and all that.

Saliva Analysis: Saliva analysis should be performed on all the cases where the victim has stated, or is unsure, that cunnilingus has occurred, on cases where the suspect has licked his fingers before penetrating the victim or to validate a statement made by an individual connected in the case. Saliva analysis will not be accomplished on rectal swabs.

Phadebas Test: The principle behind the test is that Phadebas, consisting of starch microspheres with a blue dye cross linked to the starch, are fixed on filter paper sheets. In the presence of amylase the starch is digested, leaving the water soluble dye, which flows through the pores of the filter paper.

RSID test for human saliva: RSID – Saliva is a lateral flow immunochromatographic strip test designed to find out the presence of human saliva alpha amylase, an enzyme's physiological role is to assist in the

digestion of dietary starches. Rather than examining of body fluids DNA fingerprinting is also include in forensic serology.

DNA Fingerprinting: Deoxyribo nucleic acid that is DNA is the fundamental unit that is genetic material of every living cell. It is made up of molecules called nucleotides. Each nucleotide contains a phosphate group, a sugar group, and a nitrogen base. Adenine, thymine, guanine, and cytosine that is the ATGC that is nitrogen bases of a DNA molecule. And in every individual the DNA content is similar for a particular body it may be in blood, skin, bone, hair root, semen, vaginal or rectal cell or any other cell even in bone marrow but not in RBC because RBC do not have nucleus.