

MANAGEMENT OF FORENSIC EVIDENCE IN MEDICO-LEGAL CASES: FROM CRIME SCENE TO COURT

Forensic Science

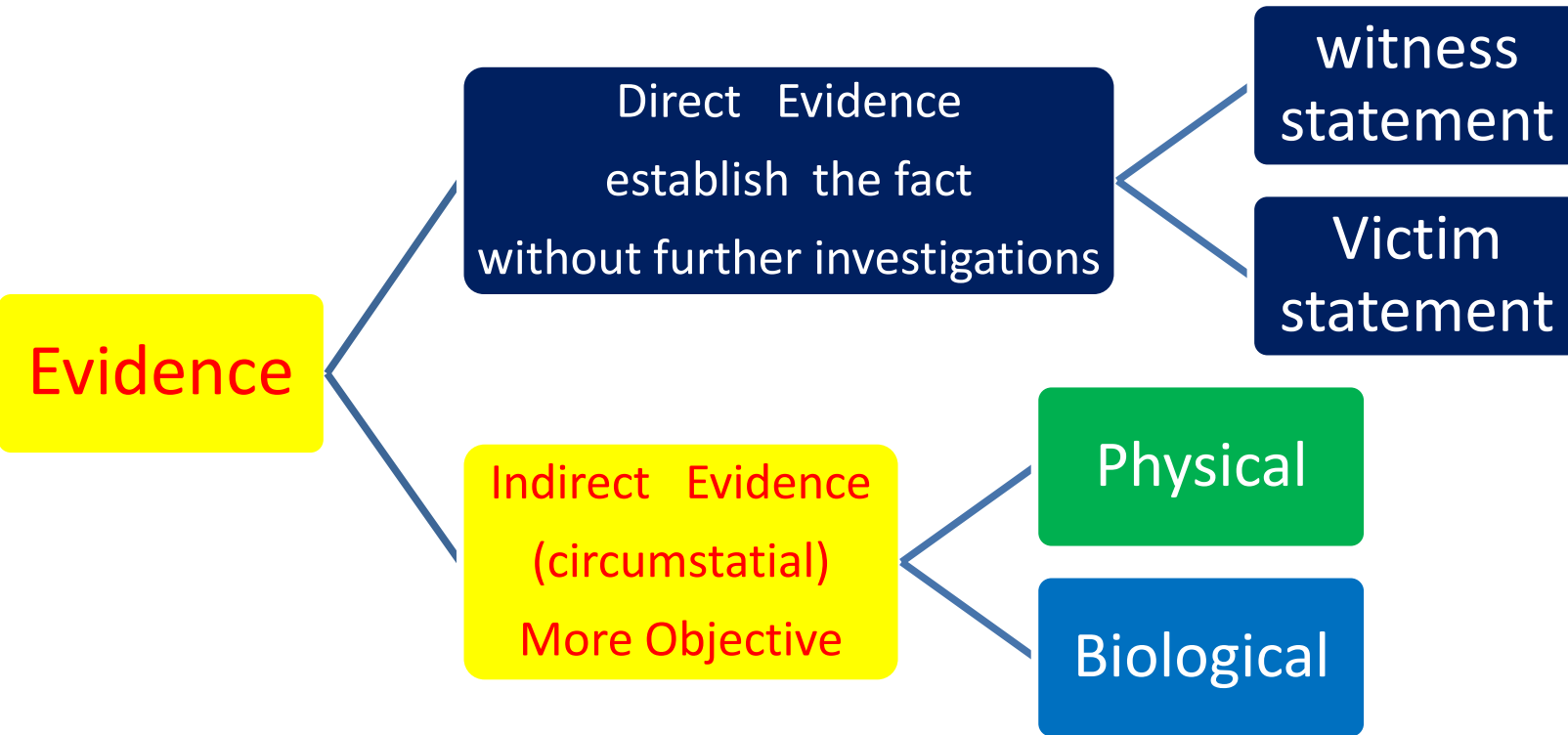


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PHYSICAL /FORENSIC EVIDENCE - IMPORTANCE

- Sources
- Utility
- Location & collection
- Identification
- Handling of Exhibits
- Packing
- Presentation in the Court

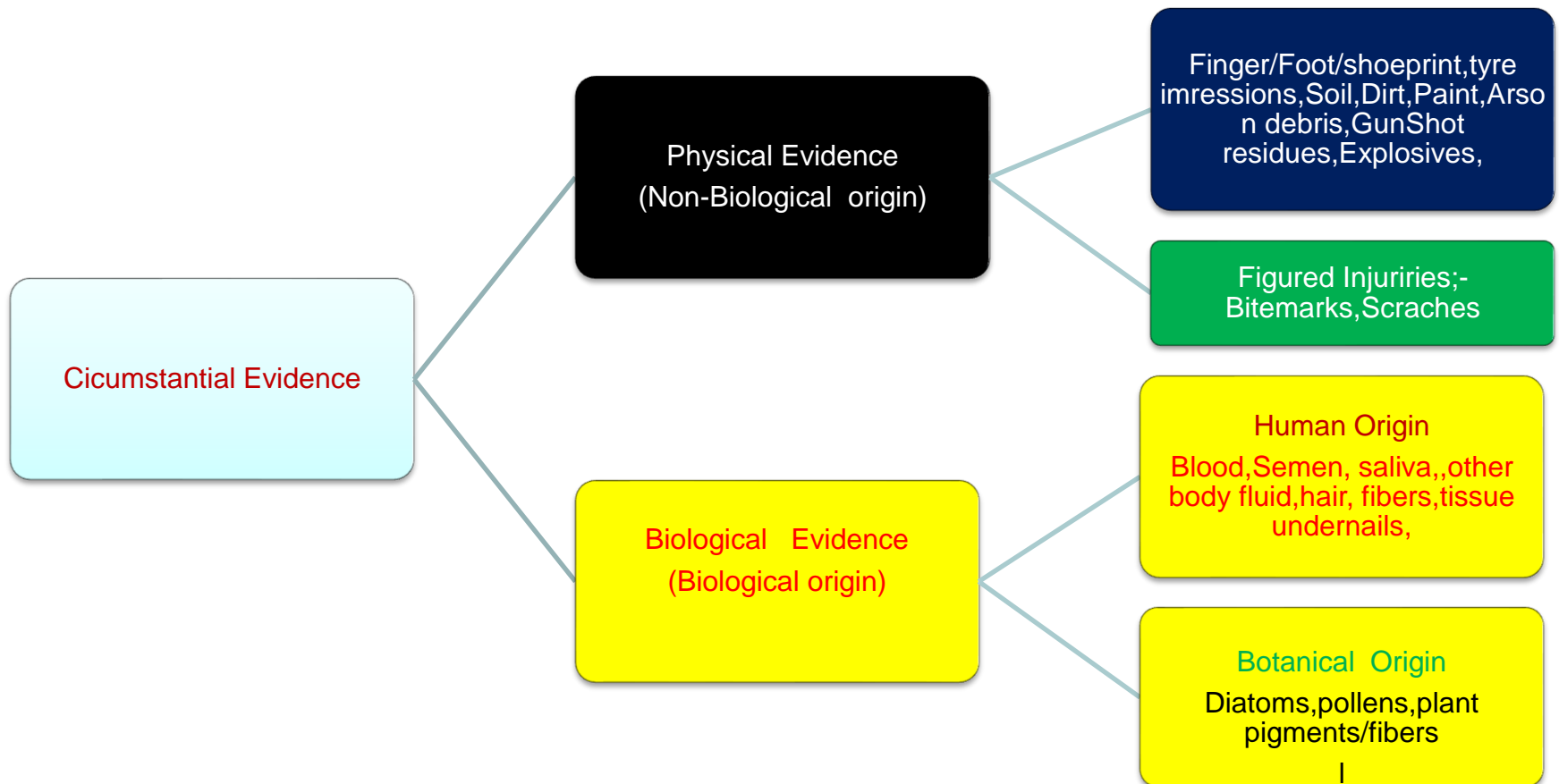
Types of Evidence



Direct Evidence-limitations

- Statements of Eye witness and Victims are:
- Prone to many inaccuracies
- May be contradicted or
- Supported by other types of evidence.

Types of Circumstantial Evidence



Indirect(**Circumstantial**) Evidence

- More Objective
- Needs to be identified and matched with control or reference samples collected from
 - Victim
 - Suspect
 - Crime scene
 - Data bank

Testimony

- A witness may testify only what he has experienced with his five senses .
- Testimony regarding his opinion is not allowed in legal system.
- However, testimony of the expert witness is permitted to offer his opinion pertaining to matters in dispute.

Expert witness

- Competent in any science, art, trade or occupation.
- Have developed skill or knowledge in a particular subject through education or experience so that he may form an opinion that will assist the fact finder.

- An expert witness can be anyone with knowledge or experience in a particular field or discipline **beyond that of a layman.**
- He uses his specialist knowledge to provide an opinion on an issue or facts in a case to help resolve litigation.

- Expert opinion is generally sought by one party, but the expert's overriding duty is to assist the court, and his report must be **independent, objective and unbiased**.
- No body can accurately claim to be an expert witness by profession, some are more competent than others.

- Report generated by the expert witness and the subsequent oral testimony should be based upon sound scientific practice, acceptable interpretation of the facts by vast majority of the scientific community and untainted by foreign interest.
- Objectivity and impartiality should be the guiding rules of an expert witness.

Blood as Forensic Indicator

- ❑ 13th Century: Chinese and Japanese used blood as forensic indicator
- ❑ For deciding issues of blood relations among individuals, they used to prick finger of concerned persons and allow the drops of blood to fall in a basin of water. If blood of both flowed together, they were declared blood-related.
- ❑ For deciding inheritor of dead person, drops of claimant's blood were allowed to fall on the bone of the deceased. If the blood soaked into the bone, he was declared the inheritor.

Such attempts appear quite illogical in the present context, however these were honest attempts for resolving issues and administration of justice

Biological Evidence Materials

- Blood/ Bloodstains
- Menstrual bloodstains
- Seminal stains
- Vaginal Secretion stains
- Saliva Stains
- Vomit
- Urine Stains

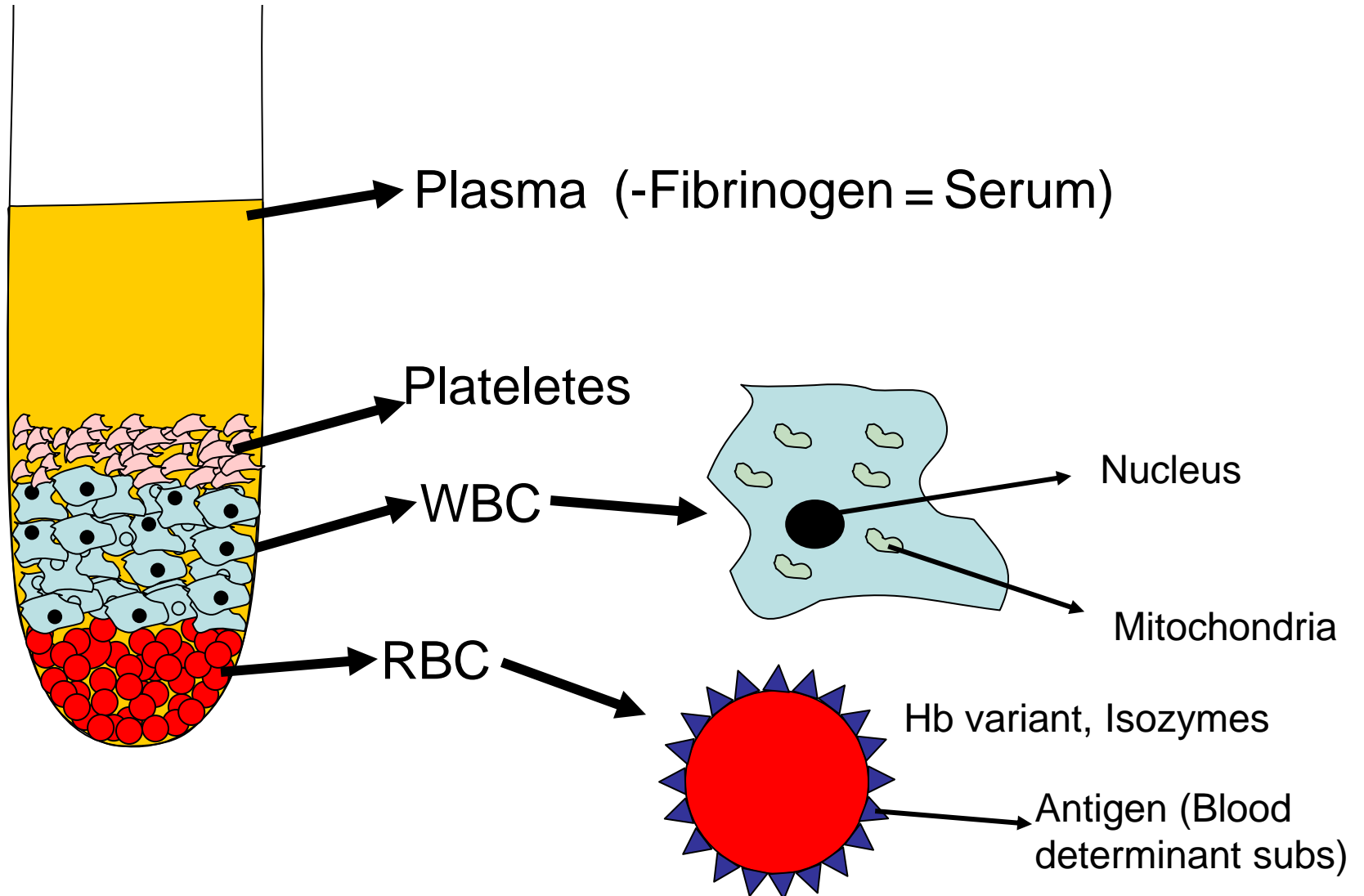
Cont....

- Faecal Matter
- Skeletal Remains
- Hair and Fiber
- Insects & Maggots
- Diatoms
- Vegetable Materials & Pollen grains
- Poisonous plants
- Microbes

Physical Evidence

- Foot / shoe /tyre impressions or prints/ Fingerprint /Lip prints /Handwriting .
- Bite marks
- Scratch marks
- Belongings of victim/suspect
- Condoms
- Cigarette /bidi butts
- DFSA evidences
- Cell phone and digital forensics
- Weapons- Knife/ Firearms

Blood Constituent



Blood Identification

- ❑ **Microscopic Identification of Cells** (*Nucleated RBC in vertebrate, chromatin bodies in WBC determine sex, sickle cell erythrocyte-person having sickle cell disease*)
- ❑ **Chemical Tests**
 - ❑ Catalytic tests (Presumptive)
 - Benzidine test
 - Phenolphthalein test
 - Leucomalachite test
 - Tetra-Methylbenzidine test
 - O-Tolidine
 - Luminol test
 - ❑ Crystal tests (Confirmatory)
 - Haemochromogen (Takayama, 1912) test
 - Haematin (Teichmann) test
 - Haemin (Wagenaar) test
- ❑ **Spectroscopic Identification**
- ❑ **Electrophoretic Identification** (*Hb fractions, HbS and HbC variants-racial origin*)
- ❑ **Immuno-Electrophoretic Identification** (*Blood=Hb+serum proteins, combination of Hb ring around the well and precipitin lines identifies blood and also its species*)
- ❑ **Chromatographic Identification** (*Stain extract applied on Whatman no.1, after ascending chromatography paper is dried in oven to deactivate any vegetable peroxidases. Under UV Haematin gives red fluorescence*)
- ❑ **Immunological Identification** (*AntiHb serum is used*)

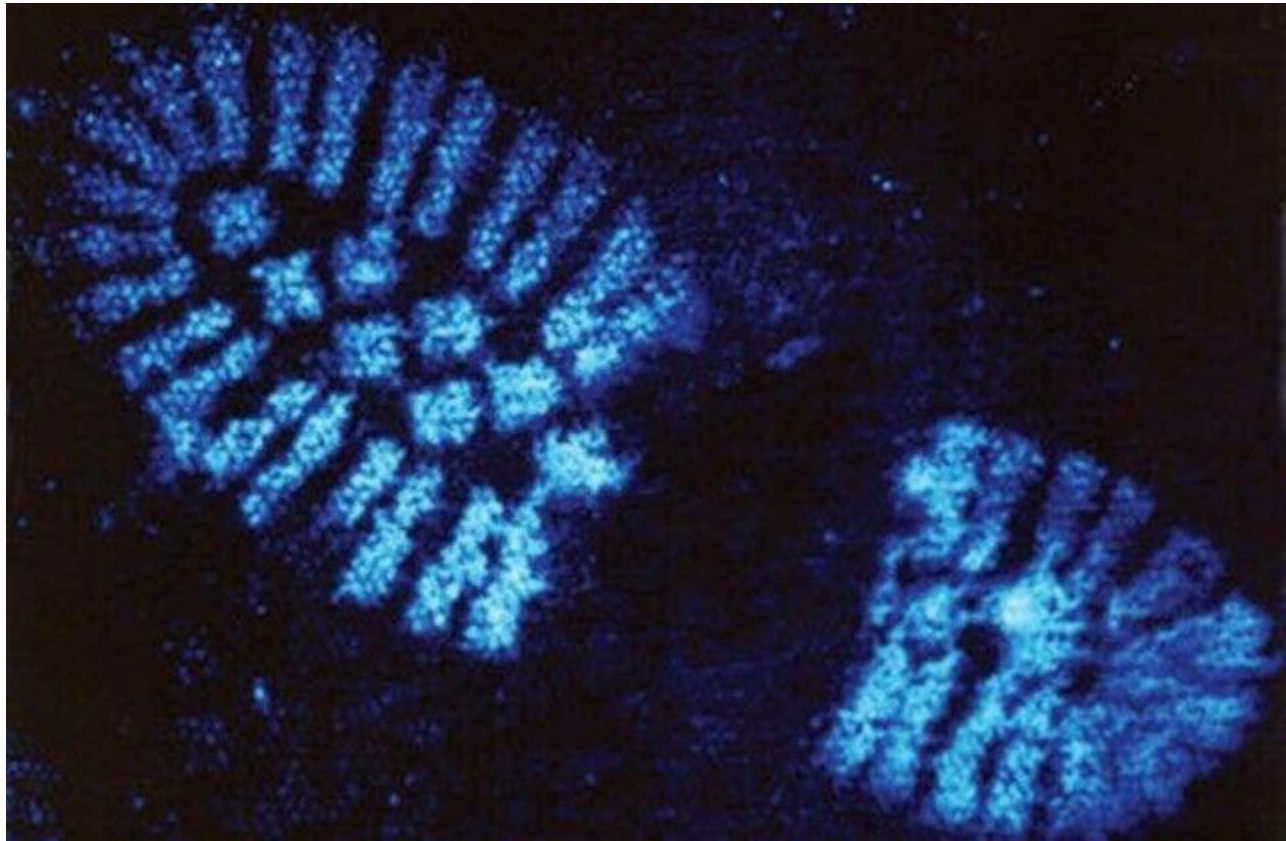
Positive



Negative









BLOODSTAINS

- Dried bloodstains are hard to remove.
- Blood does not adhere readily to swiftly moving metallic objects.
- It is very difficult & often impossible to detect blood on a bullet which has passed through a body.

Cont....

- Razors & sharp knife which have made a deep wound in a body may show little or no evidence of blood.
- Body of a woman sitting in a boat was cut nearly in half by blade of a plane flying low.
- No evidence of blood was detected on blades

Bloodstain Pattern

- Manner in which crime has taken place.
- Exact place of occurrence.
- Type of weapon used.
- Direction in which body was moved/transported .
- Whether the BSP on the suspect and his clothing is consistent with the crime scene.
- How many times the victim was hit.

Identification of Menstrual Blood

- Microscopic examination (Vaginal epithelium, desidual cells, endometrial cells)
- Fibrin degradation product determination
- LDH Isozyme

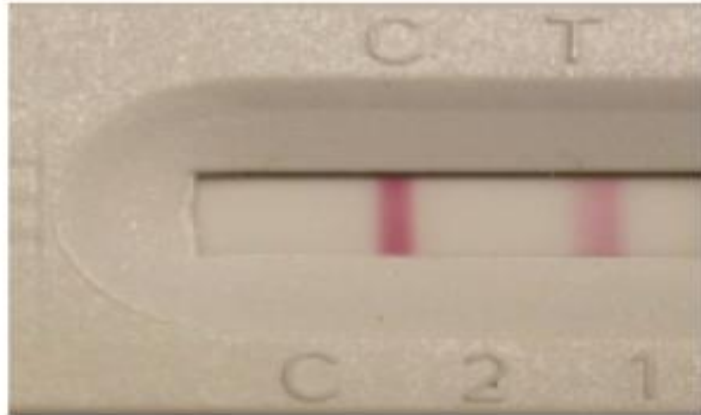
Links the perpetrator with the crime if detected on his body or garments .

Identification of Seminal stains

- Physical Examination
- Presumptive Tests
 - Acid Phosphatase Test (detectable up to 1 Year)
 - Barberios Test (spermine*)
 - Florence Crystal Test (Choline*)
- * Combination of these found only in semen
- Confirmatory Test
 - Sperm Detection
 - Anti-P-30 (even in vasectomised /azoospermic)
 - LDH isozyme
 - SAP/VAP (IEF)
 - PSA – most sensitive



RSID-Semen Test:

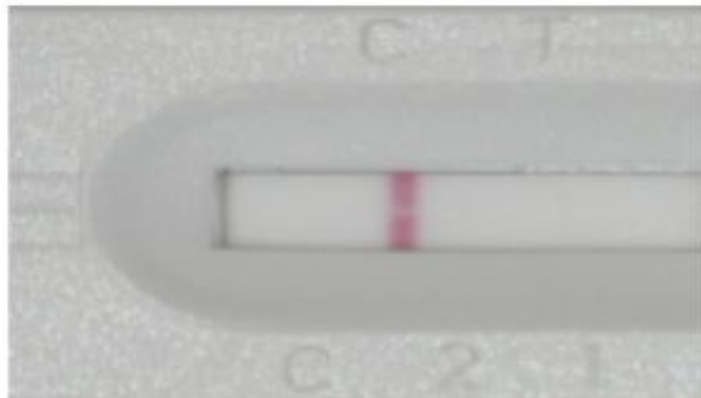


**Positive Result
(Human semen at
10000-fold dilution)**

ABAcard p30 Test:



**Positive Result
(Human semen at
10000-fold dilution)**



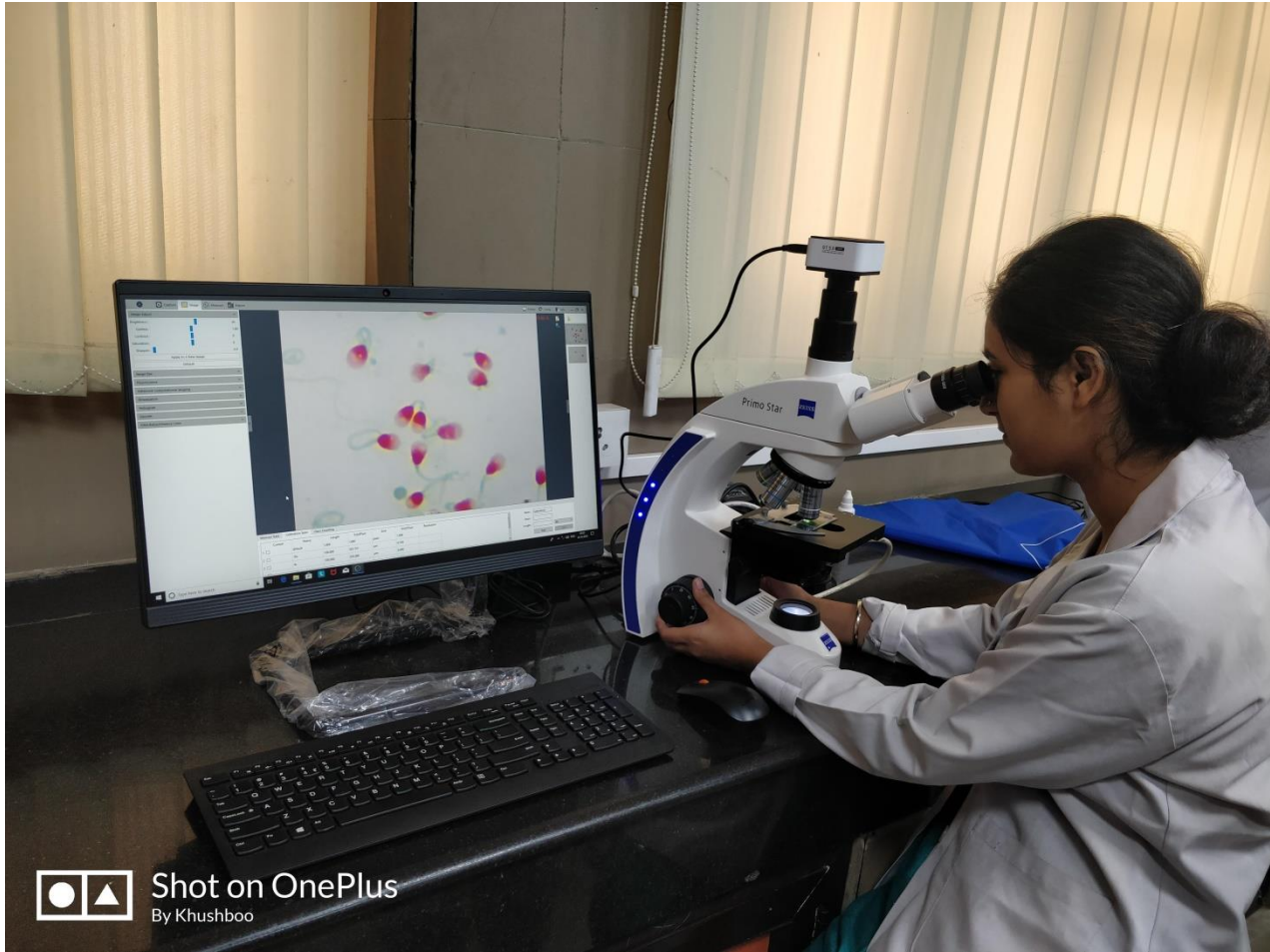
**Negative Result
(Pig Semen)**



**Negative Result
(Pig Semen)**

Fig. 1. Positive and negative results obtained from RSID-Semen Test and

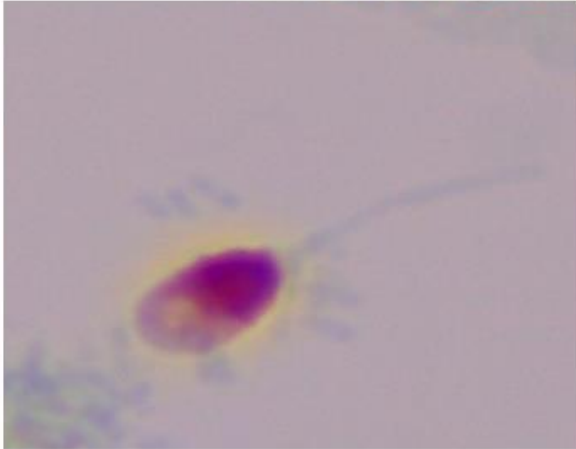
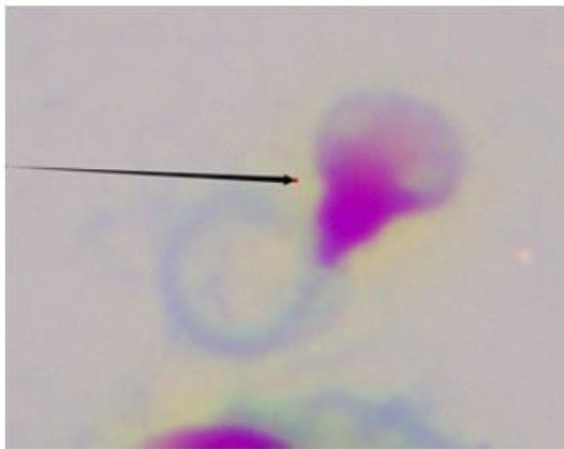
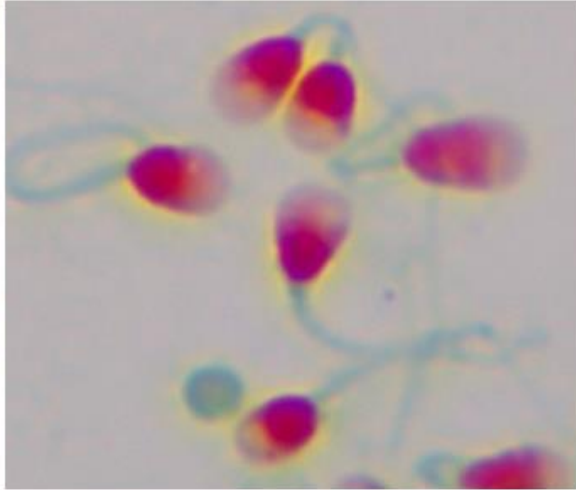
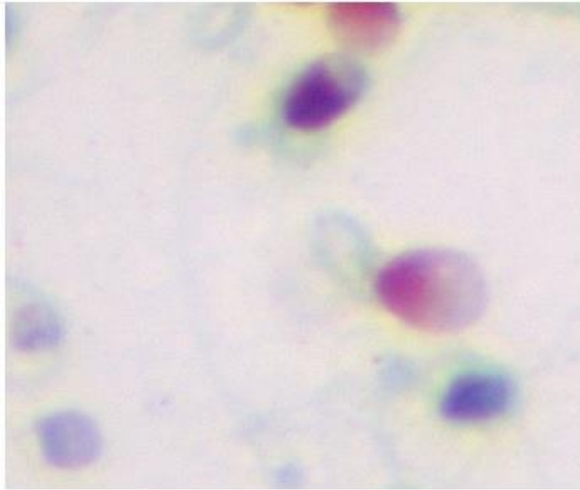




Shot on OnePlus
By Khushboo







SEMEN

- Most important type of evidence
- Its presence proves that sexual contact took place.
- Establishes Positive identity of the suspect(s) through DNA testing.
- May be found on genital/oral cavity or any other part of the body and garments. (*Urinating , defecating, vomiting ,bathing, spitting brushing teeth, eating drinking, running, walking may result in loss of evidence.*)
- Any item / surface at the SOC.

What if Semen is not Recovered ?

- Absence don't indicate that there was no sexual assault.
- Semen may not be recovered if assailants have used **condoms** or ejaculated outside the genitals or not ejaculated at all.
- *Use of alcohol or drugs, chemotherapy, cancer, infection (e.g., mumps or tuberculosis), or congenital abnormalities may suppress semen production*
- An object other than a penis may have been used for penetration.

PERSISTENCE OF SPERMATOZOA IN VAGINA AND CERVIX

- Spermatozoa may remain in the posterior fornix for as long as **17 days**, and may survive a menstrual period.

REF- Smith and Cook, (ed.) (**1928**) 'Taylor's Principles and Practice of Medical Jurisprudence', 8th ed., vol. 2. Churchill, London.

- **Intact sperms and PSA** were found in the vagina of deceased sexual assault victims during the time period ranging from **16 days to 4 months(Berrena,2018)**
- Vaginal /cervical swabs are ideal methods for collecting seminal evidence in sex related cases if collected within a designated time frame (few hours -**20 days**).

Vaginal drainage

- A natural and passive process starts soon after the sexual act depositing the seminal constituents on to the fabric of underwear/garments worn during the sexual act and also several days after .
- When victim does not report for medico legal examination within the designated /stipulated period of time following sexual assault, vaginal drainage deposited onto the victim's underwear following sexual assault or on subsequent pairs of underwear worn after the incident may be the only vital evidence for analysis.

- Study on post-coital vaginal drainage samples on panty liners reported positive test for :
- AP from 10 to 39 hrs,
- PSA from 4.5 to 47 hrs
- Sg(Semenogelin- seminal vesicle specific antigen) up to 42.5 hrs.
- Sperms heads up to 6 hrs.(Berrena,2018).
- Morphologically intact sperm has been detected from vagina of rape-homicide victim after 16 days and 34 days (P30 was also detected) .
- Postmortem vaginal recovery has been reported up to 3-4 months .

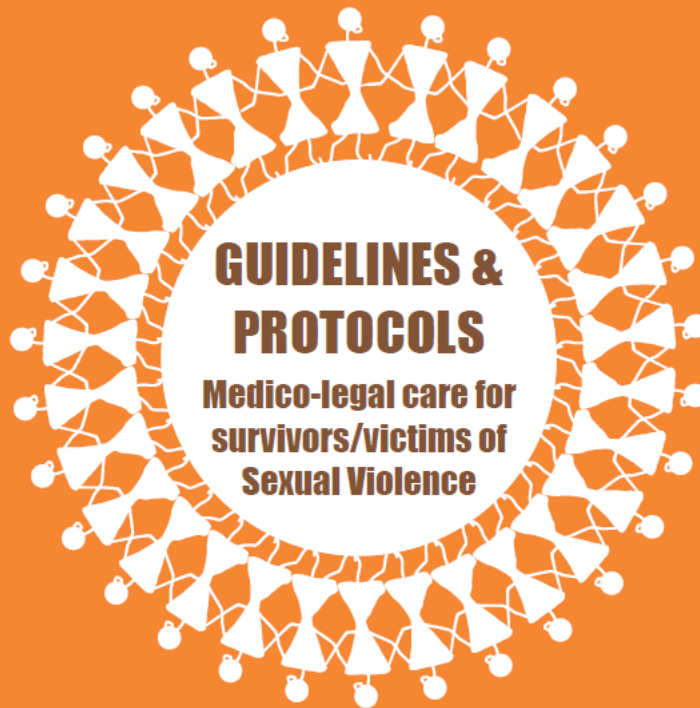
Detecting the Presence of Male DNA in Cases of Sexual Assault without Ejaculation

- Traditional forensic DNA analysis of sexual assault-type samples focuses on the identification and typing of sperm cells collected from the victim's body, clothing, or bedding.
- With more sensitive typing methodologies, it is also possible to examine fingernail clippings for foreign DNA as well as swabs collected from areas on the victim's body where the suspect was said to have kissed, licked, or bitten the victim.

- The presence of female DNA (through saliva or vaginal fluid) on the fingers, penis and/or underwear of the male attacker (large amount of nucleated cells are present in both of these fluids.)

- As we shed skin cells from our hands and other parts of our body, including the penis.
- Male DNA transfer on or inside the victim via pre-cum (pre-ejaculate fluid from Cowper's and Littre's glands is possible.
- Nearly 37 percent of pre-cum samples collected in a study contained a significant amount of healthy, motile sperm.

- If male is vasectomized , his non-sperm cells are detectable in women reporting sexual contact up to 3 weeks after sexual activity. (*Fluorescence in situ Hybridization (FISH)*)
- . Non sperm male cells could be epithelial or inflammatory cells that are indistinguishable from the victim's cells with conventional cytology.
- The male DNA detected could be from exfoliated male epithelial cells resulting from penetration.Y-STR typing s useful in such cases



**GUIDELINES &
PROTOCOLS**

**Medico-legal care for
survivors/victims of
Sexual Violence**

- If a woman reports within 96 hours (4 days) of the assault, all evidence including swabs must be collected, based on the nature of assault that has occurred.
- The likelihood of finding evidence after 72 hours (3 days) is greatly reduced; however it is better to collect evidence up to 96 hours in case the survivor may be unsure of the number of hours lapsed since the assault.
- The spermatozoa can be identified only for 72 hours after assault.
- So if a survivor has suffered the assault more than three days ago, please refrain from taking swabs for spermatozoa.



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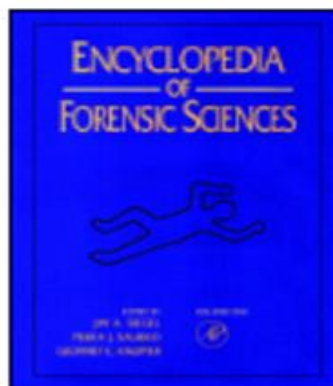
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Motile sperm The forensic medical examiner has the unique opportunity to observe motile sperm collected from the victim during the evidentiary exam. Recovery of motile sperm has only been reported from samples taken from the vagina or cervix. The technique requires the preparation of a 'wet mount' slide (vaginal or cervical swab sample placed on a slide with a drop of saline plus a cover slip) and examined with a phase-contrast microscope. The maximum reported recovery times are shown in **Table 2**.

Nonmotile sperm Although nonmotile but morphologically intact spermatozoa may be seen on the wet mount slide performed during the forensic medical examination, the identification of nonmotile sperm is usually based on the stained smears prepared by the forensic laboratory from the evidence swabs. Commonly employed staining methods include Oppitz (Christmas-tree-stain), hematoxylin and eosin (H & E) and Papanicolaou (pap smear). The slides are

terial for analysis. victim position following the assault plays an important role in the amount of vaginal spermatozoa available for sampling. Gravity drainage creates significant loss of vaginal evidence if the victim is upright after deposition. Conversely, if the victim remains recumbent following the act, recovery is likely to be greater. This has been a legitimate criticism against comparing volunteer studies (more likely recumbent) to casework studies (more often upright). If only a small number of sperm are recovered from the vagina, the possibility of sperm deposition from a contaminated object (e.g. finger) must be considered as an alternative explanation to penile penetration.

The detection of sperm on anal swabs must be interpreted cautiously. Recovery of anal sperm from a male sodomy victim or from a female sodomy victim without any detectable vaginal sperm is consistent with anal sexual contact. Difficulty arises when the female victim has both vaginal and anal sperm. Drainage of vaginal material may contami-

Table 2 Maximum reported recovery times for spermatozoa collected from body cavities in living sexual assault victims

	Vagina	Cervix	Mouth	Rectum	Anus
Motile sperm	6-28 h	3-7.5 days	-	-	-
Nonmotile sperm	14 h to 10 days	7.5-19 days	2-31 h	4-113 h	2-44 h

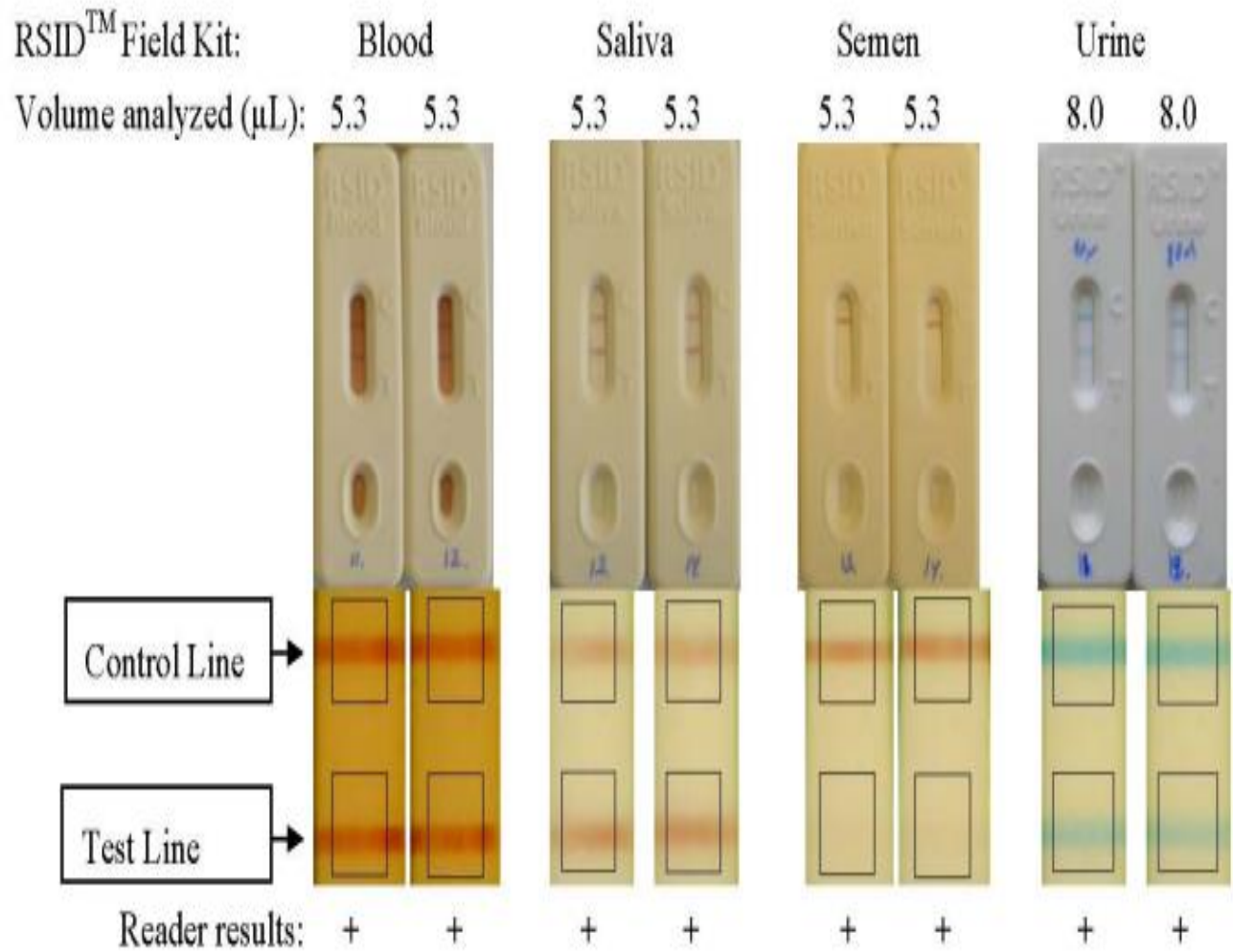
RTI REQUEST DETAILS

Registration No. :	LNJPN/R/2019/80002	Date of Receipt :	02/05/2019
Transferred From :	Directorate of Forensic Science Services on 02/05/2019 With Reference Number : DIRFS/R/2019/50052		
Remarks :	Information sought may be available in your dept		
Type of Receipt :	Electronically Transferred from Other Public Authority	Language of Request :	English
Name :	Harsh Gupta	Gender :	Male
Address :	206 b sector, vivekanand colony, ujjain, Pin:456010		
State :	Madhya Pradesh	Country :	India
Phone No. :	Details not provided	Mobile No. :	+91-9171856013
Email :	hg.harshgupt@gmail.com		
Status(Rural/Urban) :	Rural	Education Status :	Above Graduate
Letter No. :	Details not provided	Letter Date :	Details not provided
Is Requester Below Poverty Line ? :	No	Citizenship Status :	Indian
Amount Paid :	0 (RTI fee is received by Directorate of Forensic Science Services (original recipient))	Mode of Payment :	Payment Gateway
Request Pertains to :			
Information Sought :	After intercourse between the male and the female, till how much time sperm of male will be identifiable or present inside the female vagina. Please provide the 3 certified copies of the records mentioning above in forensic department. It is related to my life and for justice so please provide me with in 48 hours		

Examination of Saliva Stains

- Test for Amylase
 - Starch iodine test
 - Radial gel diffusion
- LDH Isozyme

Links the perpetrator with the crime through DNA contained in his buccal cells recovered from the body of the victim.



Examination of Hair and Fibre

- Determination of species, sex, race, site (scalp, pubic, vulvar, chest, beard, axillary, eyebrow, limb, ear, anal), genetic markers .
- Fiber Examination – Identification of common textile fiber is done by
 - Microscopical examination
 - Staining test
 - Solubility test
 - Floatation test
 - Burning test
 - Physical test like direction of twist

Examination of Vomit

- Mucus
- Free HCL
- Endothelial cells

Examination of Faecal Matter

- **Physical Appearance** (Generally brown due to Urobilinogen, in infants yellow due to Bilirubin and milk diet)

- **Microscopic Examination**
 - Moistened in DW on slide + Iugol's iodine, put cover slip, examine for undigested food particles, vegetables material, muscle fibers

- **Confirmatory Test**
 - **Urobilinogen Test**

Based on detection of Urobilinogen (formed in intestine by reduction of bilirubin)

 - Stain extract + 40% Mercuric Chloride in Methanol + Amyl Alcohol, shake and centrifuge. Examine supernatant under long wave UV. No fluorescence at this stage.
 - Add 40% Zinc Chloride in Methanol. Shake and incubate at RT for 30-60min. Examine under long wave UV. Green fluorescence is positive test for Urobilinogen indicative of the presence of faecal matter.

Examination of Skeleton

- Species of origin
- If Human
 - Sex
 - Age
 - Stature
 - Identification of person by photo-superimposition technique

Superimposition technique for skull identification

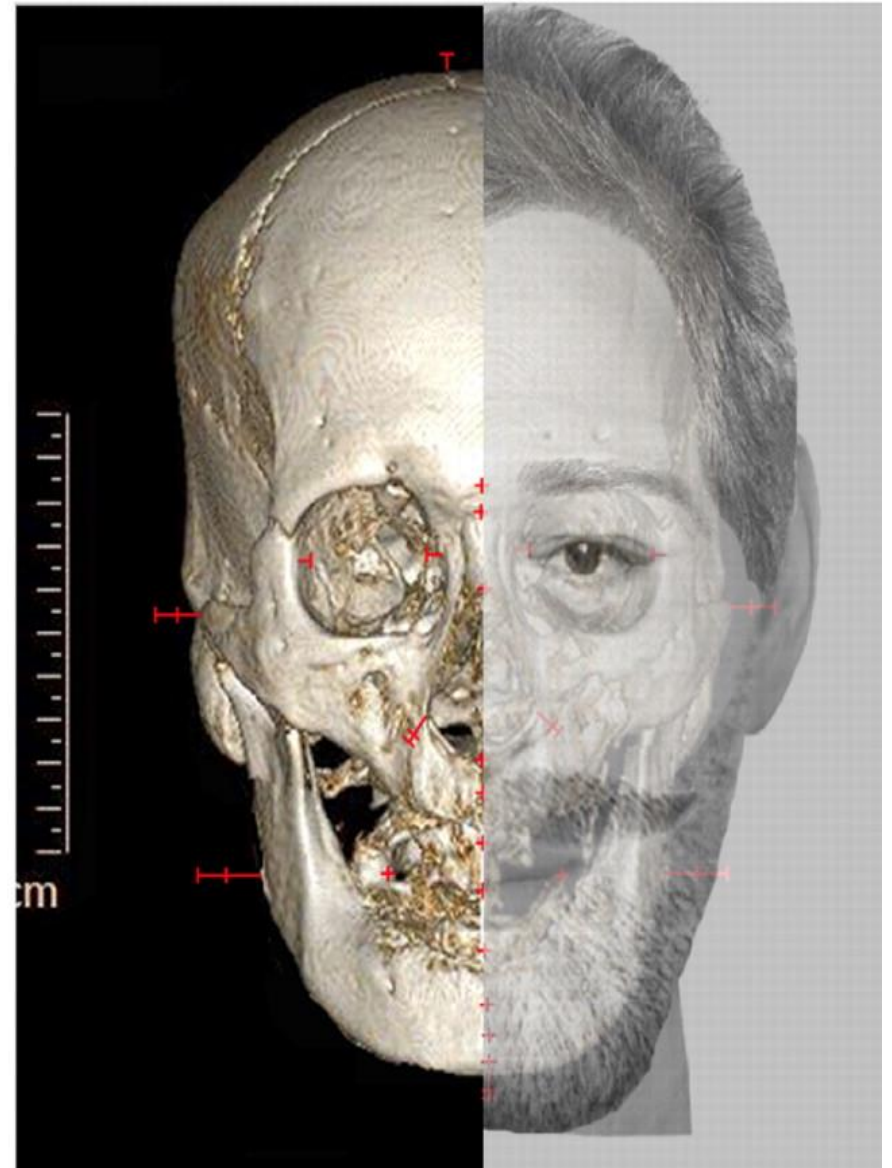
The craniofacial superimposition technique is still an important way of identifying skulls in situations when:

- there is no reference sample for a forensic DNA analysis
- DNA typing from remaining tissue samples has failed
- ante mortem dental records are not available.

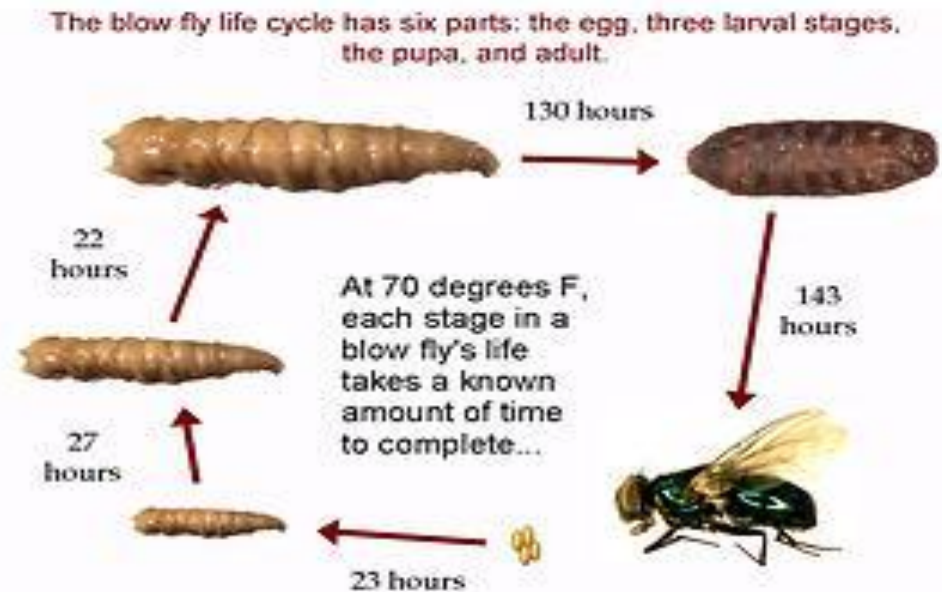
A



B



Adult female blow flies arrive within minutes to lay eggs on a cadaver. Each deposits about 250 eggs in the natural openings of the body and open wounds. The eggs hatch into first-stage maggots within 24 hours. These feed and then molt into second-stage maggots, which feed for several hours, and then molt into third-stage maggots. Masses of third-stage maggots may produce heat, which can raise the temperature around them more than 10° C. After more feeding, the third-stage maggots move away from the body and metamorphize into adult flies.



Examination of Diatoms

- ❑ Diatoms are aquatic unicellular plants having rigid coating of silica found in lakes, rivers, oceans, seas ditches and soil.
- ❑ Over 10,000 different species of diatoms differing in shape, size and design have been reported
- ❑ In drowning cases diatoms enters the blood streams through lungs and are carried to brain, liver, bone marrow etc.
- ❑ Diatoms can reveal the place of drowning and in highly putrefied bodies where others signs of drowning are not visible, establish the cause of death.

DIATOMS

Domain : *Eukaryota*

Kingdom : *Chromalveolata*

Phylum : *Heterokontophyta*

Class : *Bacillariophyceae*

- Diatoms are phytoplankton (microscopic algae).
- They are extremely widespread and occur as the dominant organisms of many diverse habitats.
- They are particularly conspicuous in both marine and freshwater bodies..

Order : Centrales

Family: Coscinodisceae



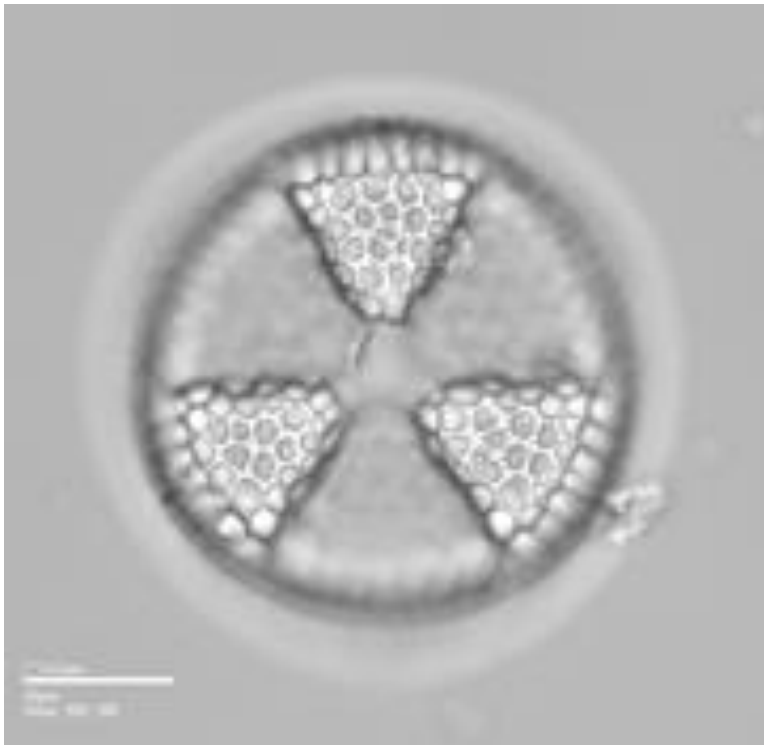
Genus : *Coscinodiscus*
Species : *radiatus*



Genus : *Coscinodiscus*
Species : *granii*

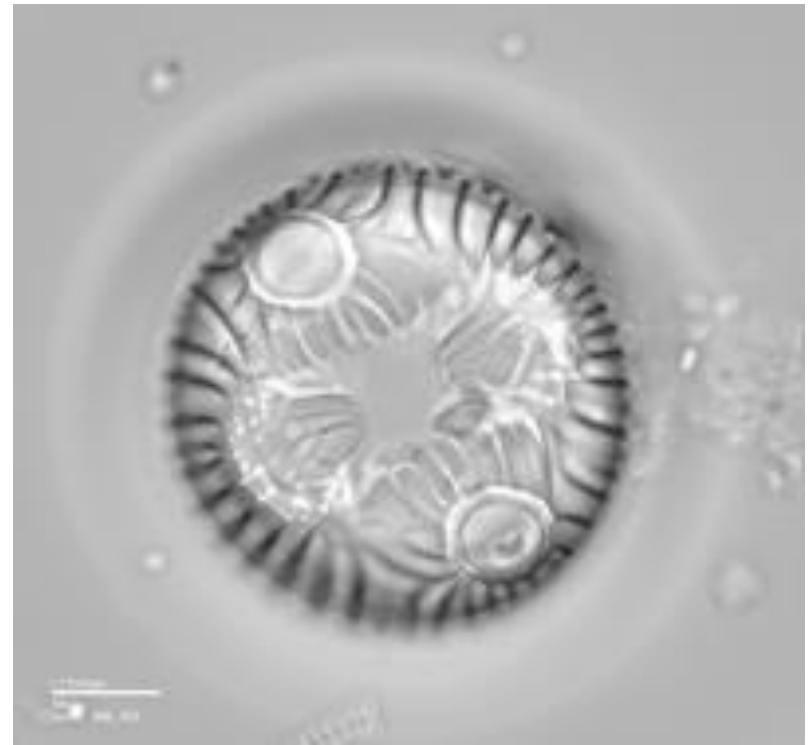
Order : Centrales

Family: Actinodisceae



Genus : Actinoptychus
Species : senarius

Family: Eupodiscaeae



Genus : Auliscus
Species : sculptus

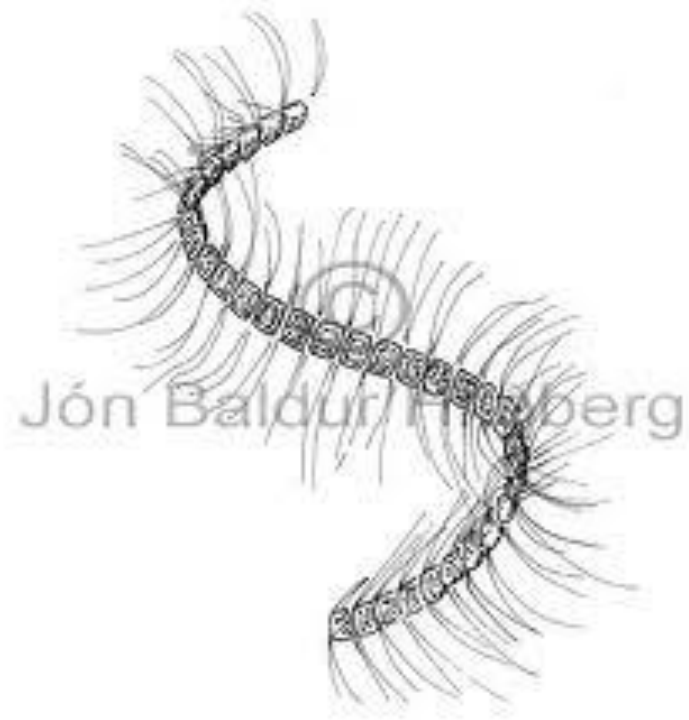
Order : Centrales

Family: Solenieae



Genus : Rhizosolenia

Family: Chaetocereae



Genus : Chaetocereae

Species : debilis

Order : Centrales

Family: Biddulphiaeae



Genus : Triceratium
Species : pentacrinus

Family: Euodieae



Genus : Hemidiscus
Species : cuneiformis

Order : Centrales

Family: Anauleae

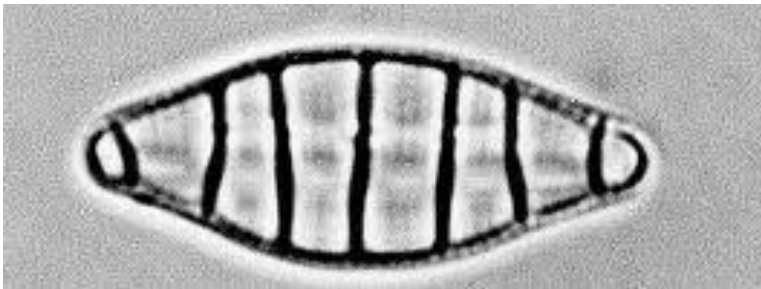
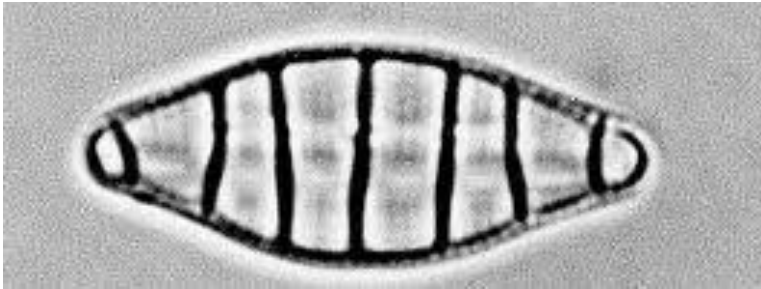


Genus : Eunotogramma

Species : marinu

Order : Pennales

Family: Tabellarieae



Genus : Denticula
Species : tenuis

Family: Meridioneae



Genus : Licmophora
Species : flabellata

Examination of Pollens

- ❑ Pollen grains are male reproductive units of plants produced in flowers.
- ❑ Pollens are easily transferred to clothing or any other object which touches the flowering plants.
- ❑ Presence of pollens on the clothing, earwax proves normal habitat of the person.
- ❑ Identification of Pollen grains helps in linking criminal with the crime.

Pollen analysis

- Pollen grains are abundant in almost all environments, are very durable and may persist on surfaces and in soils for many years .
- The pollen produced by flowering plants and conifers, along with the spores produced by ferns are microscopic and not visually obvious trace evidence at a crime scene.
- By examining the morphology of tiny pollen grains it is possible to identify the genus and often the species of the plant.
- Conducting analysis on multiple pollen grains allows for the vegetation composition of an area to be determined.

SEROLOGICAL ANALYSIS

System	Father	Mother	Child	Paternity
ABO	A 1	A1	O	Possible
Rh	Rh1 rh	Rh1 Rh1	Rh1 rh	Possible
MN	M	M	M	Possible
Hp	2-2	2-1	2-1	Possible
PGM	2-2	2-1	2-1	Possible
EsD	2-1	2-1	1-1	Possible
GLO	2-1	2-1	2-1	Possible
ADA	2-1	1-1	1-1	Possible
EAP	BB	BB	BA	Not Possible
AK	1-1	1-1	2-1	Not Possible

GLO	2-2	2-2	2-2
PGP	1-1	1-1	1-1
PGI	1-1	1-1	1-1
SOD	1-1	1-1	1-1
Hb	AA	AA	AA
Hp	2-2	2-2	2-2
Secretor	sese	SeSe/Sese	sese

Antibody Profiling

- Everyone has a unique antibody profile.
- At birth, antibody are identical to those mother
- Then profiles gradually change until about the age of 2, then a stable pattern is formed.
- Then antibody profile never changes.
- Identical twins have their own unique individual antibody profile.

Foot/Shoe Prints



Footprint

- One of the valuable physical evidence left by criminal unintentionally at a crime scene .
- Analysis of footprints can provide useful information to establish personal identity and ease the crime investigation

- Footprint is similar to finger print in their uniqueness.
- Both have individual characteristics that are capable of proving positive identification.
- Like finger prints, no two people have the same palm print or footprint.

Case Laws

- Rejecting the contention that the study of footprints is not a science in *Din Muhammad v Emperor*, Central Provinces Police Gazette dated 27th May, 1914 pp. 125-130, the court of the Judicial Commissioner at Nagpur (H.J. Stanyon and H.F. Hallifax, A.J. Cs) as far back as in 1914 held:

“The knowledge of footprints has similarly been systematized and pursued by trackers, mainly uncivilized and ignorant people in all other respects, all over the world. The matter is therefore undoubtedly a science and the opinion of a person specially skilled in it is a relevant fact, under Sec-45 of the Evidence Act “

In the case of *Pritam Singh v State of Punjab* (AIR 1956 S.C. 415) there is an observation to the effect that the science of identification by footprints is a rudimentary science and much reliance cannot be placed on the result of such identification.

VIKRAM SINGH *versus* STATE OF HARYANA

High Court of Punjab and Haryana, Chandigarh

DATE OF DECISION: 26.5.2006

- The defence side has also examined 8 defence witnesses to counter the prosecution case.
- The prosecution witnesses so examined was Dr.K.P.S.Kushwaha (PW2), FSL, Madhuban, Karnal.
- He inspected the scene of occurrence in the presence of the Investigating Officer in the intervening night of 20/21.2.1996.

- Thirdly, the conviction of the appellants was based only on circumstantial evidence.
- One of such circumstances is the foot prints noticed on a leather bag allegedly found lying at the spot by Dr.K.P.S.Kushwaha (PW2).
- The impressions were faint and partial.
- Though the bag was picked up and taken to the laboratory but it was not duly sealed at the spot, nor was a seizure memo in respect thereof prepared, nor a witness to the seizure was cited.
- The bag was returned to the police station unsealed on 23.2.1996.

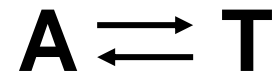
Four nitrogenous bases

DNA has four different bases:

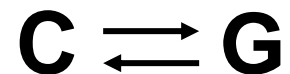
- Cytosine **C**
- Thymine **T**
- Adenine **A**
- Guanine **G**

Important:

- Adenine and Thymine always join together



- Cytosine and Guanine always join together



DNA Sequence

- About 6.4 billion base pairs are arranged along the 46 chromosomes in a unique sequence in our each cell
- 2 lac pages of telephone directory are required to type the sequence of bases (DNA sequence) along the entire length of DNA
- Reading the DNA sequence nonstop at the rate of 10 bases/sec (ATCGATCGAT/sec) or 600 bases/min. or 3600 bases/hr or 8,64000 bases/day or 3,53,60,000 bases/year, it would take 9.5 years to complete the job

Gene: DNA

- ❑ Human Body contains ~ 220 types of specialized cells.
- ❑ Only Nucleated Cells contain chromosomes, made up of DNA.
- ❑ Sex cells act as vehicle for bringing $\frac{1}{2}$ the genetic information from each parent to the offspring
- ❑ DNA programmes the working of cell.
- ❑ 99.9% of human DNA is same in every individual, only 0.1% of our DNA is unique.

DNA can be extracted from :

- Blood /Semen/ Saliva and their stains
- Organs and tissues
- Bones, teeth
- Hair
- Urine and faecal matter
- Sweat, tears, ear wax, finger print
- Skin and muscle tissues
- Dandruff
- Samples of plant origin
- Microorganisms

- DNA samples have been obtained from **vaginal cells transferred to the outside of a condom** during sexual intercourse.
- Cells in the outside layer of skin contain few or no nuclei
- Nucleated cells may be transferred from the skin surface through sweat and sebaceous oil secretions.
- Hence, DNA deposited on any surface through casual contact can be recovered and typed using sensitive PCR based technique

- Urine (when concentrated) and faecal matter also contain nucleated cells
- Hair shaft and nail clipping contain mt. DNA
- Concentration of sperm and **semen** and epithelial cells in **saliva** is higher than that of blood cells in blood, hence less amount of semen/saliva is required as compared to blood.
- Thus quantity of all the samples depends upon density of the nucleated cell per sample.
- DNA can be isolated from liver, spleen, gonad, kidney and skin
- **Liver and brain decompose first, prostate gland and uterus gland are last to decompose**

- Wild life samples
 - Brain, heart, red muscles, hide with attached reddish tissues are best.
- Microbial samples
 - Identification of pathogens (Anthrax) in terrorist cases

DNA Content of tissues

1 Sperm	= 3 pg
1 Blood cell	= 6 pg
1 Plucked hair	= 300 ng
1 Shed hair	= 10 ng
1 Drop blood	= 1500 ng
1 mg liver	= 15 micro gm
1 mg muscle	= 3 micro gm

Application of DNA in Forensics

- Criminal cases
 - Blood, Semen, saliva, bone, hair, and other body tissues encountered in physical and sexual assaults, murder, accident, concealment of birth
 - Identification/restoration of kidnapped/exchanged babies
 - Identification of babies born out of wedlock or sexual assault
 - Identification of mutilated bodies in mass disaster cases, when conventional method of identification fail

- Identification of plant materials and microbes
- Identification of species of biological evidence material in poaching cases.
- In cases of sudden death/unexplained deaths in athletes and in cases of sudden infant death syndrome, sequence analysis of human cardiac-beta-myosin heavy chain gene using mRNA extracted from PM tissues to verify genetic defect
- In linking cases e.g different rape cases –serial rapist
- Civil Cases
 - Determination of paternity/maternity
 - Inheritance cases
 - Immigration cases

- Medical Applications
 - Post transplant cell population identification
 - For monitoring engraftment.
 - Twin zygosity determination
 - Tumor analysis
 - Identification of micro organism
 - Tissue culture cell line identification

Soil microbial DNA profile

Represent the site of collection-
proves a link between suspects
and crime scene.

- Traditional Chinese medicine stated to contain Tiger-bone were found to contain cow and pig DNA.

- DNA profiling of azoospermic semen-epithelial /white cells –Y STR

- Micro organisms as foodstuff contamination.
- In medical negligence cases involving infections- HIV transmission.
- Natural disease out break.
- Anthrax (spores of bacillus anthracis)- in act of bioterrorism.

- Success has been reported in the recovery of DNA from burned remains extracted from fire victims exhibiting extreme charring.

- In China - Bus with 35 sleeper berths caught fire at 4 am which was put off at about 6 am .
- Bodies inside the vehicle were carbonized, and could only be identified through DNA

