

## Lecture 4:

- CHAPTER (23):PRINCIPLES OF FORENSIC SCIENCE
- CHAPTER (24): Allied Forensic Specialties

● Book

● notes

● Important

# CHAPTER (23):PRINCIPLES OF FORENSIC SCIENCE

Locard's exchange principle: 'every contact leaves a trace.'

Scene examination : (Aim : to secure, identify and preserve evidence)

- A **crime scene** is a zone is cordoned off, within which all people accessing or leaving are entered into (and have to sign) a 'scene log'.
- **Crime Scene Manager (CSM)** is in overall charge of the scene and controls the personnel that assist in the examination .
- **Scene of Crime Officers (SOCOs)** is in charge of evidence gathering
- **Police Search Advisory (POLSA)** staff in charge of 'fingertips'.  
If there are human remains at crime scenes, examinations are focused on the
  - immediate area around the remains so that they can be removed for a post- mortem examination (**why?**) → **remains are prone to rapid changes, especially during the first few weeks of decomposition.**

## Packaging differ based on the evidence:

### Evidence recovery :

- 1- Evidence assigned an exhibit number.
- 2- Photographed before removed
- 3- Packaged.

<b>Paper sacks</b>	For clothing because, if item is slightly damp, this allows moisture to pass through.
<b>Plastic bags</b>	Used for items such as cigarette ends.
<b>Plastic tubes</b> / known as <b>weapons tubes</b>	Used for sharp items such as knives or screwdrivers .
<b>Cardboard boxes</b>	With plastic ties to secure the item in place.

# Chain of custody:

- Once an exhibit has been created, each time it is transferred from one place to another, the details need to be recorded.
- Continuity forms, tells that the exhibit has been passed from one person to another.
- Once examinations of an exhibit have been concluded, it is retained for a period of time before it is destroyed or, on occasion, returned. But, often not destroyed.

## Sample analysis :

### • DNA analysis

**First step** → dissolve the sample in appropriate chemicals to ensure the maximum amount of DNA can be recovered.

**Second step** → carried out so that the correct amount of the extracted sample is removed for the next step.

**Third step** → Amplification is carried out using the polymerase chain reaction (PCR), which uses an enzyme-catalysed reaction over a number of cycles.

- The power of DNA analysis is realized when one considers that (in the UK) **10 different loci** are analyzed, giving a total of 20 alleles in each process.

### • Body Fluids Analysis

<i>Blood</i>	<i>Semen</i>	<i>Saliva</i>	<i>Touch "DNA "</i>	<i>Urine</i>	<i>Faeces</i>
<b>The presumptive tests</b> used are Leucomalachite Green (LMG) or Kastle–Meyer (K–M) both filtered by hydrogen peroxide. If color changes to green for LMG, pink for K–M when blood has a peroxidase like activity from hemoglobin (=confirmed blood stain).	acid phosphatase (AP) test, purple color develops (=confirmed semen)  *Bacterial infections can give false reactions with AP reagent (a pinkish colour).	Phadebas test detects the presence of amylase. Blue color (=confirmed saliva).	depositing skin cells, used to assist in the identification of wearers of garments such as gloves.	dimethylaminocinnamaldehyde (DMAC) test to detect the presence of urea.  Chemical creatinine test, another constituent of urine.	Edelman's test, which detects the presence of urobilinogen, a chemical constituent of faeces.

# Blood Pattern Analysis :

- **Downward drips**

Downwards drips are formed when blood falls from a surface (such as the end of a finger) under the force of gravity.

- **contact blood staining**

Contact bloodstains are formed when a blood-stained item comes into contact with another, non-stained item

- **Impact spatter**

When someone is struck in an area that bears wet blood staining, the stains can be broken up and projected away from the area of impact.

*\*it is characterized by a number of different sized blood stains on surrounding surfaces. The greater the force that is applied the smaller the stains tend to appear.*

- **Physically altered blood stains**

Physically altered over time or by the addition of other body fluid.

## If they land on :

**Flat surface** → characteristic circular stain .

**Absorbent surface** → much smaller, while still being of the same volume .

- **cast-off**

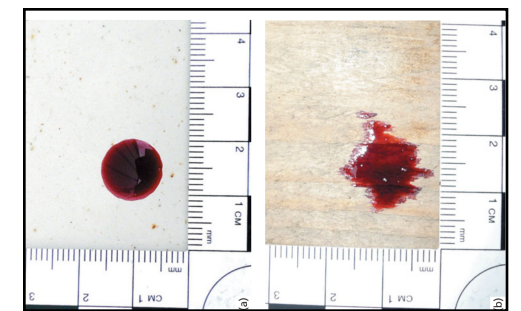
When an item bearing blood staining is moved through the air with sufficient force to drive blood from its surface.

- **Arterial spurting**

When an artery is damaged blood is projected under high pressure, which does not happen with venous bleeding.

- **Luminol**

Highly sensitive chemiluminescent compound can help the scientist visualize where blood staining had been present before any such cleaning efforts.



Downward drips



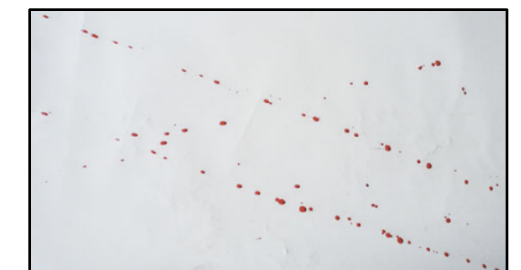
contact blood staining



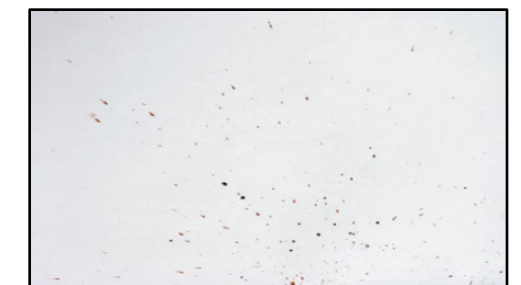
Arterial spurting



Luminol



Cast-off



Impact spatter

## Damage :

Using controlled tests and reconstructions, it is also possible to comment on whether or not a specific item or action caused an area of damage.

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## Fingerprints :

- The theory that fingerprints are unique to each person that enabled them to become one of the primary methods of identification.
  - The overall nature of a fingerprint can be described as loops, whorls or arches of sweat glands within the ridges, an impression of these secretions can be left as a fingerprint on a surface (latent marks).
  - Fingerprints may also be left (patent marks) if there is a contaminant such as ink, blood or paint.
  - Scanning the fingerprints with the database to find the suspects.
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## Footwear :

**Footwear marks:** depend on many factors, such as how dirty the sole of the shoe is or the floor surface itself. Examination of footwear involves comparing the sole pattern, size and degree of wear in the mark found at a scene with a test mark made from an item of footwear.

**Footwear marks and skin:** When contact is made with a person with a degree of force, by kicking or stamping, then skin deposits may be transferred to the inner surface of clothing while next to skin.

## Trace evidence :

**Glass** : broken glass fragments would transfer to the individual. Length of time that these glass fragments remain on clothing would depend on many factors, such as the type of clothing and the activity of the individual.

**paint** : If damage is caused to a painted surface then small flakes can be transfer. Each type of paint may be discriminated by its colour, texture and composition.

**Fibres** : based on certain characteristics enable the forensic fibre examiner to identify sources of fibres.

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## Fire investigation :

The fire investigator will be concerned with determining the 'defect, act or omission' that led to the fire to improve fire prevention.

**And has to determine two principal facts:**

1- the origin . 2- a consideration of what may have started it.

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## Firearms :

**two main types :**

1. **Smooth-bore barrels:** which usually fire groups of shot (Shotguns).
2. **Rifled barrels:** which usually fire single bullets (hand guns and rifles).

\*Air guns and air rifles form a separate group of weapons that rely upon compressed gas, such as air or carbon dioxide, to propel a projectile; however, most of these weapons, even low-power ones directed appropriately have the ability to cause lethal injury .

# CHAPTER (24): Allied Forensic Specialties

## 1-Forensic ecology :

is the use of environmental evidence types to assist in investigating crime, both outdoors and indoors. It consists of diatomology, palynology and entomology.

1. **Diatomology:** Diatoms are algae, microscopic unicellular plants, which can be found in saltwater, freshwater, soils and damp surfaces. When diatoms die, their skeletons sink to the bottom layers of water. By extracting diatoms from organs that have been collected under the correct conditions to protect against contamination, the scientist can comment on whether or not drowning contributed to death.
2. **Forensic palynology:** uses analysis of pollen, spores and other microscopic particles. **Pollen** is seasonally and geographically sensitive, and may be dispersed by water, wind and insect activity.
3. **Forensic entomology** is the application of knowledge about insects to assist in legal investigations, the vast majority of which are suspicious deaths or murders. The most commonly encountered insects are **blowflies**, but other flies and beetles are often found.

### Pollen evidence can be used to:

- 1-Link people, vehicles, and objects to a known scene or deposition site.
- 2-Identify habitats or geographical locations relevant to police investigations.
- 3-Prove or disprove alibis.
- 4-Assist in determining the season and location in which an individual died.
- 5-Help determine possible locations of a missing person by looking at the clothing of a suspected offender.
- 6-Help determine the fate of an individual prior to death.

### insect analysis can be used to:

- 1-An estimated post-mortem interval (PMI).
- 2-Whether or not a body has been moved from one location to another
- 3-Whether a body has been moved between a concealed and exposed environment.
- 4-Whether there has been abuse and neglect.
- 5-Whether there are public health issues.

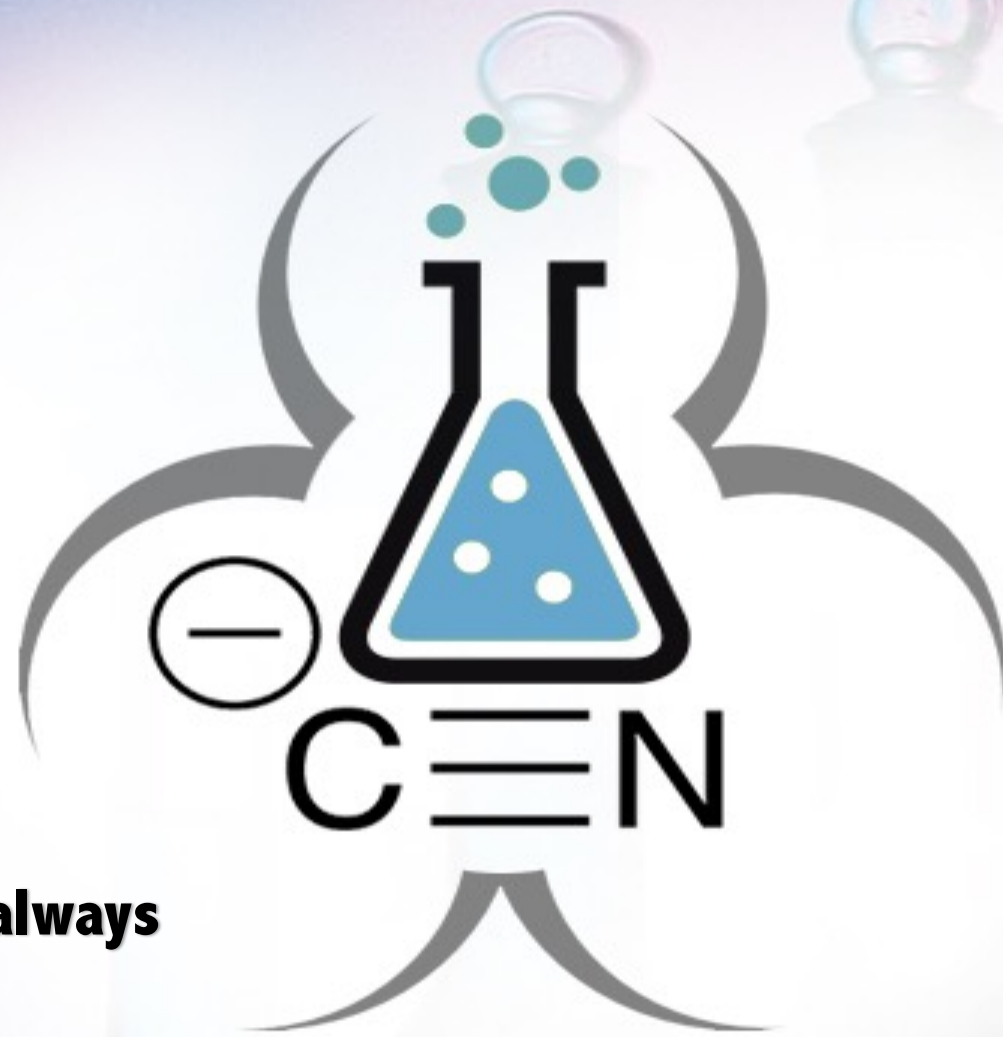
**2-Forensic archaeology:** is concerned with the **location, recovery and interpretation of buried evidence**, mostly human remains, and associated items that may be within the grave, as well as buried items such as stolen goods, firearms and drugs. The forensic archaeologist will use their knowledge of land surface characteristics to determine whether or not there could be a burial site.

**3-Forensic anthropology:** is the study of the **biological and cultural aspects of humans**. Initially identifying human remains in the medicolegal setting. Once bones have been identified as human, the forensic anthropologist will attempt to establish a biological profile of the individual, or individuals. Depending on the completeness of the remains, this may include **sex, age at death, height and possible ethnicity**. Age estimation is a complex area and the anthropologist is well placed to be part of a team that may include physicians, odontologists and radiologists.

**4-Forensic odontology:** is practiced by those initially trained as dentists. Forensic odontologists **apply their dental skills in the forensic setting** and are key players in human **identification** (of the living and deceased), **ageing** (of the living and the deceased) and in the identification and interpretation of **bite marks**. Odontologists attempt to identify dental patterns and features and compare these either with known ante-mortem information about the individual or relate such information to known published population data.

**5-Forensic photography:** is a very specialized area embracing a range of imaging techniques that allow best presentation of visually relevant evidence in an appropriate format. Forensic photographic techniques can include **the use of ultraviolet, infrared and polarized light photography**, which can be used to enhance or identify items or injuries of interest. A key element of forensic photography is data management of images and how these are stored and reproduced.





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