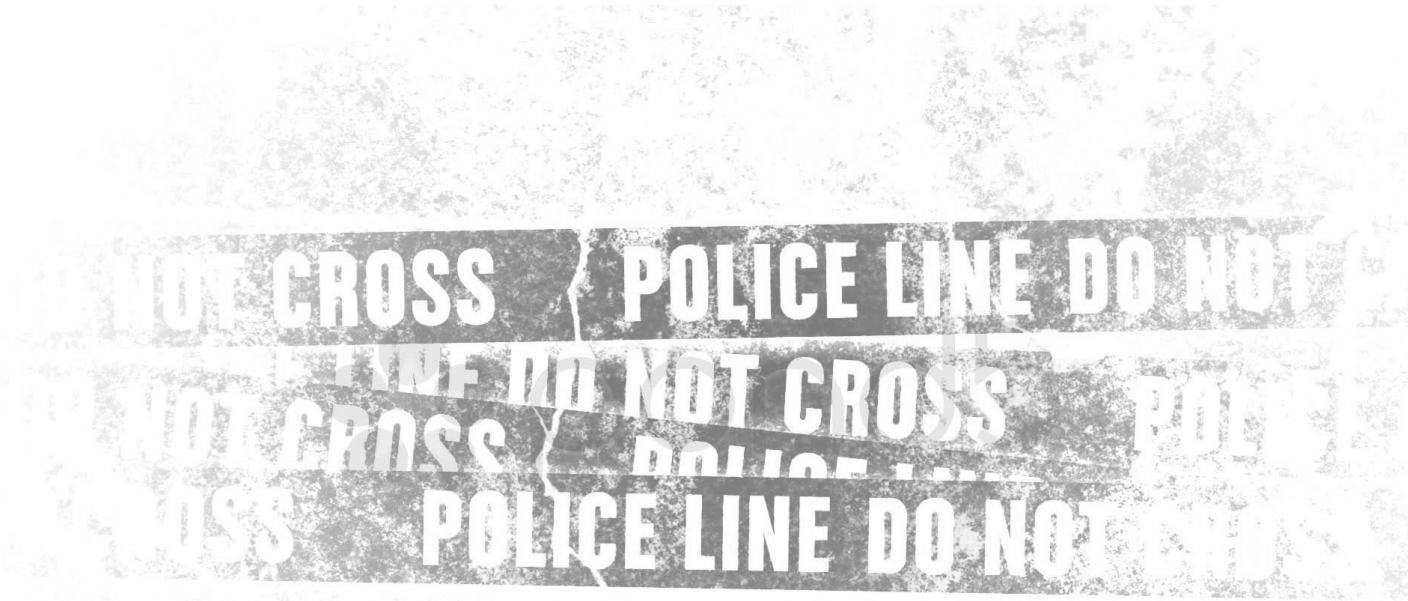

Principle in Forensic Examination

Chapter 1 & 23-24

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Correction file

Chapter 1

Principle in Forensic Practice

Introduction

You need to understand here that the legal system is evolved over the years because of religion aspect, culture and politics. Moreover there is a wide difference between one country to another in legal system (abortion for example). Now we can divide legal system to 2 broad areas **Criminal** & **civil.**

Legal System

Laws are rules that govern orderly behaviour in a collective society and the system referred to as 'the Law' is an expression of the formal institutionalization of the promulgation, adjudication and enforcement of rules.

To simplify the definition rules announced and applied by the government in the society.

There are many national variations but the basic pattern is very similar.

...Continue Chapter 1

in both civil and criminal trials, the person against whom the action is being taken is called the **defendant**; the accuser in criminal trials is the state and in civil trials it is the **plaintiff.**

Criminal Law

- Criminal law deals with relationships between the state and the individuals.
- Criminal trials involve offences that are 'against public interest'
  - Against the person (e.g. murder, assault, grievous bodily harm, rape).
  - Property (e.g. burglary, theft, robbery).
  - Public safety and security of the state (terrorism).
- In a criminal trial it is for the prosecution to prove their case to the jury.
- The defence does not have to prove innocence because any individual is presumed innocent until found guilty.
- The penalties that can be imposed in the criminal system commonly include
  - Financial (fines).
  - Loss of liberty (imprisonment).
  - Community-based sentences.(unpaid job for example).
  - Capital punishment (execution).
- Special courts are utilised (تستعمل) for those under 18 years of age.

Civil Law

- Civil law is concerned with the resolution of disputes between individuals (حل النزاعات بين الافراد)
- All kinds of dispute may be encountered, including those of alleged negligence, contractual failure, debt, and libel or slander .
- Most remedies are **financial**
- Civil cases has three divisions:
  1) **Chancery** – specializing in matters such as company law.
  2) **Family** – specializing in matrimonial issues and child issues.
  3) **Queen's Bench** – dealing with general issues.

Doctors & The Law

For doctors are circumstances in which doctors become involved with the law simply because they have professional skills or experience. may have one of two roles either as a professional witness or as an expert witness

Professional Witness

- A professional witness is one who gives factual evidence (واقعي)
- **For example,** a doctor may confirm that a leg was broken or that a laceration was present and may report on the treatment given.

No comment or opinion is generally given.

Expert Witness

- An expert witness is one who expresses an **opinion** about **medical facts.**
- **For an example** Give an opinion about the cause of the fractured leg or the laceration or ability of an individual with angina to drive a passenger service vehicle.

There are often situations of overlap between these professional and expert witness roles. **For example** a forensic physician may have documented a series of injuries having been asked to assess a victim of crime by the police and then subsequently be asked to express an opinion about **causation**. forensic pathologist will produce a **report** on their post-mortem examination (professional aspect) and then form conclusions and **interpretation** based upon their findings (expert aspect).

So we can say that
professional witness → report (there is no opinion)
Expert witness → interpretation or causation (depend on the opinion of the expert)

Evidence for Courts

Statements and reports التقرير

- A statement or a report in a criminal case is prepared in a particular form so that it can be used as **evidence**.
- The effect of this declaration is to make the individual liable (عرضة) for criminal prosecution (الملاحقة القانونية) if they have lied.
- A statement provided when acting as a professional witness (like we said before who gives a report) will be based on the contemporaneous (معاصر) notes (notes or records made at the time of examination), and it is important that the statement fairly reflects what was seen or done at the time.
- A statement may be accepted by both defence and prosecution, negating the need for court attendance (no need for attendance) ,**for example,** if the defence do not accept the findings or facts expressed, the doctor will be called to court to give live evidence and be subject to examination, cross-examination and re-examination.

Attending court

You must attend the court if they ask you to appear as a witness and there is no need for written order. And by failure to attend the court you will face some consequences (fine or prison time …est)

Evidences

- When witness called to the court and they will Take an oath or swearing in; to ensure they are telling the truth .
- Once the oath has been taken, the witness is liable for the penalties.
- Whoever has 'called' the witness will be the first to examine them under oath; this is called the **'examination in chief'** to confirm the truth of the statement
- When questioning about the statement is completed, the other lawyers will have the opportunity to question the witness; this is commonly called **'cross-examination'**. To test the evidence that has been given.
- The final part of giving evidence is the **'re- examination'**. Here, the original lawyer (the first lawyer) has the opportunity to clarify anything that has been raised in cross-examination but he cannot introduce new topics.

Doctors in Court

Any medico-legal report must be prepared and written with care because it will either constitute the medical evidence on that aspect of a case or it will be the basis of any oral evidence (by the doctor) that may be given in the future.

When become the witness:

1. Should the voice heard and clear.
2. Be respectful.
3. The answer should be short as possible and clear meaning.

Preparing for Medical Reports

- A report may be requested by the police, prosecutors, Coroners, judges, medical administrators, government departments, city authorities or lawyers of all types.
- **So**, The most important question that doctors must ask themselves before agreeing to write a report is whether they :
    1. Have the expertise to write such a report.
    2. Have the authority to write such a report.
- If medical records need to be reviewed there should be a written permission from the individual themselves or individual with power to give that consent
- The doctor **shouldn't** disclose all information about medical details of the victim in his/her report, thus the doctor **must** limits his report to relevant details on the case only.
- Mandatory reporting of medical issues may be relevant in some countries; often these relate to terrorism, child abuse, use of a weapon.

Doctors in Court

Structure of a Statement of Report

- The basis of most reports and statements made at the time of an examination and it is essential to remember that copies of these notes, will be required in court if you are called to give live evidence.
- A simple professional witness statement (one that simply reports facts found at examination) will be headed by specific legal wording. Included may be the doctor's professional address and qualifications. The **date** of the report is essential and the time, date and place of any examination(s) **should** be listed, as should the details of any other person who was present during the examination.
- In simple terms summarize your medical findings. And information other than observation during a physical examination (e.g. medical records, X-rays) which forms part of the basis of the report, must be recorded. (Of Course only relevant medical details to the case.)
- Medical abbreviations should be used with care and highly technical terms, especially those relating to complex pieces of equipment or techniques, should be explained in simple.
- Abbreviations in common usage such as ECG can generally be used without explanation although occasionally further explanation is required.
- Autopsy reports are a specialist type of report and may be commissioned by the **Coroner**, the **police** or any other **legally competent person.**
- The authority to perform the examination will replace the consent given by a live patient, and is equally important.
- The history and background to the death will be obtained by the **police** or the **Coroner's officer**, but the **doctor** should seek any additional details that appear to be relevant, including speaking to any clinicians involved in the care of the deceased and reviewing the hospital notes.
- Doctors must resist any attempt to change or delete any parts of their report by lawyers who may feel those parts are detrimental to their case; any requests to rewrite and resubmit a report with alterations for these reasons should be refused

Chapter 23

Principle in Forensic Science

Locard's exchange principle

"Every contact leaves a trace"

Much of the work of forensic practitioners is based on the principle described by Edmond Locard. When applied to a criminal setting it states that if someone comes into contact with a scene, then something will be brought into the scene, and something will be taken away.

Scene Examination

- The aim is to **secure**, **identify** and **preserve evidence** that may have value in a subsequent court setting.
- A crime scene is an entity which is created when police cordon off an area of interest in relation to an actual or a suspected crime.
- **Crime Scene Manager (CSM)** is in overall charge of the scene and controls the personnel that assist in the examination. The CSM acts as liaison with the **Senior Investigating Officer (SIO)** as to examination strategy depending on the demands of the enquiry
- It is usually the **CSM** who is the point of contact for all those examining the scene as the **SIO** has overall management responsibility for the case to be taken forward.
- **Scene of Crime Officers (SOCOs)** is in charge of evidence gathering.
- Within a crime scene certain precautions need to be taken to ensure that contamination is not introduced. Wearing overalls, gloves, overshoes and masks ensures that the minimum. It is best to avoid touching anything at all, as all surfaces can harbour evidence. **For example**, light switches or door handles may be of interest for DNA or fingerprints. Staff examining scenes may have to move across the floor on stepping plates as there may be footwear (or other) evidence that still needs to be recovered.
- **Generally speaking**, if there are human remains at crime scenes, examinations are focused on the immediate area around the corpse so that they can be removed for a post-mortem examination. **The reason for this is simple**; corpse are prone to rapid changes, especially during the first few weeks of decomposition, making evidence recovery by both scientists and pathologists more challenging.

- Once evidence gathering by **SOCOs** and scientists is complete, other searches can take place. These are the 'fingertip' searches carried out by **Police Search Advisory (POLSA)** staff. Following this examination, the scene can be closed down. In the case of premises, they may remain in police possession but be made secure and alarmed, or in the case of external areas, the cordon is removed and normal life resumes.

Evidence Recovery

1. At a scene, however large or small, once items of forensic interest are found, they are recorded appropriately and assigned an affidavit or exhibit number. They are usually given the initials of the person responsible for the item being **'seized'** (very often an exhibits officer) followed by a **sequential number**, for example 'JDM.1' .
2. The item is usually **photographed** before being removed carefully .
3. And then packaged.
   - **a. Paper Sacks** are used for **clothing** because, if the item is slightly damp, this allows moisture to pass through.
   - **b. Plastic Bags** can be used for items such as **cigarette** ends.
   - **c. Plastic Tube** (Known as weapon tube). used for sharp items such as knives or screwdrivers.
   - **d. Cardboard boxes** for such items with plastic ties to secure the item in place.

Exhibit label contains details describing the item, its origin, the person seizing the item and the time and date of seizure.

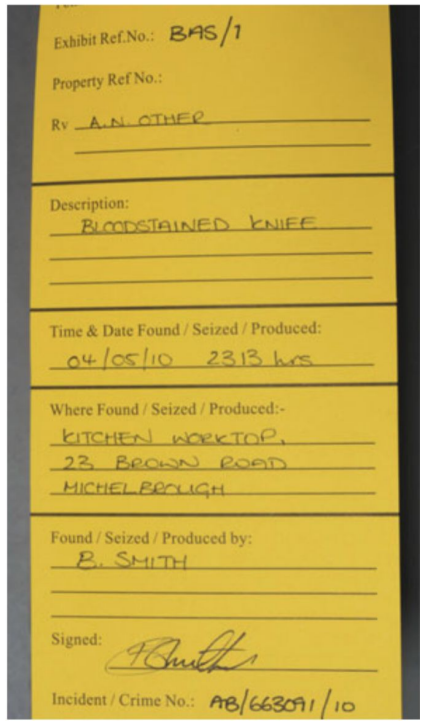


Exhibit label

Plastic Tube

Chain of Custody

- Once an exhibit has been created, every time that it's transferred from one place to another, the details need to be recorded. This is the 'chain of custody'
- This is achieved by using continuity forms which demonstrate that the exhibit has been passed from one person to another. When an exhibit is placed in a secure store, this fact is logged along with the location of the exhibit so it can easily be relocated when required. Each person who has examined the item as part of their work signs the exhibit label to demonstrate they have seen the item.
- Once examinations of an exhibit have been concluded, it is retained for a period of time before it is destroyed or, on occasion, returned. This can be **3 months** in more routine cases or at least **30 years in serious cases**.
- Often, items are not destroyed as personnel may realize that advances in technology could reveal evidence that is not at that time apparent.

Sample Analysis

DNA Analysis

What is DNA profiling?

is a forensic technique used to identify individuals by characteristics of their **DNA**

Within most cells in the body there is a nucleus containing 23 pairs of chromosomes. Half of these are inherited maternally and half paternally. The same, or different forms of each complementary area on each paired chromosome (with the exception of the sex chromosomes) may be inherited. DNA is also present in mitochondria within cells; this is inherited through the maternal lineage.

At the time of writing, the most common type of DNA profiling utilizes the fact that there are apparent (comparatively) short regions on chromosomes that repeat themselves a number of times. These are called **short tandem repeats (STRs).** These are believed to be non-coding and are conserved from generation to generation. The amount of repeats varies between individuals but the range of variation is relatively low and, by themselves, each STR (so-called allele) occurs quite commonly (generally between 5% and 20% of the population). A person can have the same (homozygous) or different STRs (heterozygous) at each region (locus) that is analysed. 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.

Sample Analysis

Continue … **DNA Analysis**

How is a DNA profile obtained?

1. **The first step** is to dissolve the sample in appropriate chemicals to ensure the maximum amount of DNA can be recovered from the source material.
2. **Extraction** stage, the amount of DNA within the sample is estimated. This is usually minute and measured in terms of nanograms (10–9 g). This stage is carried out so that the correct amount of the extracted sample is removed for the next stage .
3. **Amplification** is carried out using the polymerase chain reaction (PCR), which uses an enzyme-catalysed reaction over a number of cycles.

- The loci that are amplified vary in the number of repeats that are commonly encountered and so a range in size and thus molecular weight exists. This is exploited by the equipment used to process the amplified sample so a profile can be obtained.
- As each allele passes through the reader it registers as a peak in intensity of the fluorescent dye (The alleles that are amplified are tagged with a fluorescent dye) . This is translated onto an **electropherogram (EPG)** which represents a DNA profile as a series of peaks along a graphical line.
- If DNA profiles do not match then they could not have come from the same person. If there are only one or two areas that do not match then, as DNA is inherited and is more similar between family members than unrelated people, one may suspect that the sample under consideration originated from a closely related individual and may current more investigation. If profiles match, then they could be from the same person and the probability is extremely low that there is someone else who has the same profile with the exception of identical twins.
- **Of Course** less information or incomplete profile there will all lot of matching and visa versa.

Sample Analysis

DNA Statistics and Bayes Theorem

- Discussion of DNA profiling inevitably involves terms such as 'likelihood of a match', or 'probability'. These are used in the expression of the strength of the evidence and the methodology used relies on the use of Bayesian statistics, so-called from the theories developed by Thomas Bayes.
- Bayesian statistics assist in providing a model to determine that **probability**.
- In relation to DNA evidence, if we consider a single DNA profile from a crime scene that matches a given individual, one can assess the probability of **two hypotheses**:
  A. The DNA originated from that person.
  B. The DNA originated from another, random person

It is very important when considering DNA evidence (and indeed other forensic evidence), that it is expressed as the probability of the scientific evidence given the hypotheses under consideration, **not** the probability of the hypothesis given the evidence. This is termed **transposing the conditional** and can lead to a complete misrepresentation of the scientific evidence in court.

Mixed DNA Results

- A DNA profile can often be a mixture of DNA from more than one person. This is very common, especially in cases of **sexual assault** and can lead to significant complications in interpretation.
- If a case involves people who are closely related this can also complicate analysis as they are more likely to share alleles that unrelated people. SGM+ (it is DNA profiling system which use 28 cycles) is a very sensitive technique. Typically, it is possible to get a complete DNA profile from less than 300 cells. This ability to get a DNA profile from small amounts of biological material emphasises the need to reduce contamination risks as far as possible.

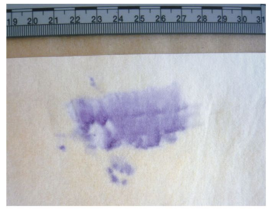
Body Fluid analysis

1- Blood

★ blood is identified by its colour and the chemical reaction. Blood does not always appear red/brown in colour and can vary to yellow or even clear depending on the type of stain which has been left.

★ The tests that used are Leuco- malachite Green (LMG) or Kastle–Meyer (K-M). Both involve the addition of the reduced form (colourless) of each reagent to the filter paper followed a few seconds later by hydrogen peroxide. If a colour change occurs after the addition of both chemicals, and the colour of the original stain was typical **(to green for LMG, pink for K-M)** of a blood- stain, then the presence of blood is confirmed. The colour change occurs as blood has a peroxidase like activity from haemoglobin, which catalyses the oxidation of each chemical.

★ When bloodstains cannot be seen, different methods of detection need to be used. **For example** wiping filter paper in a systematic manner over areas and sequentially testing these can help localize staining on dark surfaces.



2- Semen

❑ Semen is detected by forensic scientists using the acid phosphatase (AP) test, as acid phosphatase occurs in high levels in human semen. When testing clothing or other larger items this involves a press-test of filter paper onto a dampened item suspected to bear semen staining. The filter paper is then removed and sprayed with the AP reagent. If a **purple** colour develops, the presence of semen is indicated. Then we do microscopic and if we see spermatozoa then the presence of semen is confirmed.

❑ It should be noted that in houses where adult male clothing is washed with the rest of the laundry, sperm cells found normally on their underwear may be expected to be transferred to other items within the wash.

❑ If a male has been vasectomized successfully, no sperm cells should be present within an ejaculate. In these cases, a second chemical test can be used to confirm the presence of semen. This is for **prostate specific antigen (PSA)** and uses an antibody- based technique to demonstrate the presence of PSA. The **Florence Iodine test** can also be used, where a small amount of the reagent is introduced to a slide carrying some of the extracted stain. If characteristic **brown crystals** form then the presence of semen is confirmed. However, this method is not very sensitive and caution should be taken in the interpretation of the results.

Body Fluid analysis

3- Saliva

- Detects the presence of **amylase**, an enzyme found in high levels in human saliva. The most commonly used method for amylase is the Phadebas test.
- Which can be used in two ways. It can be used in a press-test whereby Phadebas paper is placed against the item under test and wetted. If a uniform **blue** colour develops, the presence of amylase is confirmed. The Phadebas test can also be used as a tube test whereby stains/swabs are extracted and measured quantities of liquid supernatant can be added to a solution of the test reagent. This method can be extremely useful in cases where staining is suspected to be very light as it is highly sensitive and easier to interpret than the press-test method.
- Care needs to be taken in the interpretation of Phadebas results as other human body fluids such as vaginal secretions, sweat and faeces can also contain amylase, albeit usually at lower levels. It should also be borne in mind that **not** all people secrete salivary amylase; therefore, its absence does not mean that saliva was not present.

4- Touch DNA

depositing skin cells, used to assist in the identification of wearers of garments such as gloves.

5- Urine and Faeces

- On occasion, the presence of urine or faeces needs to be confirmed, **for example** from cases of alleged anal rape or deliberate soiling of items.
- **In the case of urine**, tests such as the dimethylaminocinnamaldehyde (DMAC) test can be employed to detect the presence of urea, a chemical constituent of urine. Other tests can also be employed, for example for the chemical creatinine, another constituent of urine. Both of these tests rely on colour changes to provide positive results.
- **Stains suspected to be faecal** in nature can be tested using Edelman's test, which detects the presence of urobilinogen, a chemical constituent of faeces.

Blood Pattern Analysis

The nature and distribution of the staining can vary greatly, depending on several factors among which are:

- The type of blood vessel damaged;
- The location of the damage (exposed or under clothing).
- The mobility and actions of the injured individual after receiving the injury.

1- Downward drip

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

- If they land on a flat surface, they will make a characteristic circular stain.
- If blood is dropped onto an absorbent surface such as carpet, the stain can be much smaller while still being of the same volume. And if it continue it will make smaller stallet shape projected away from area of impact.

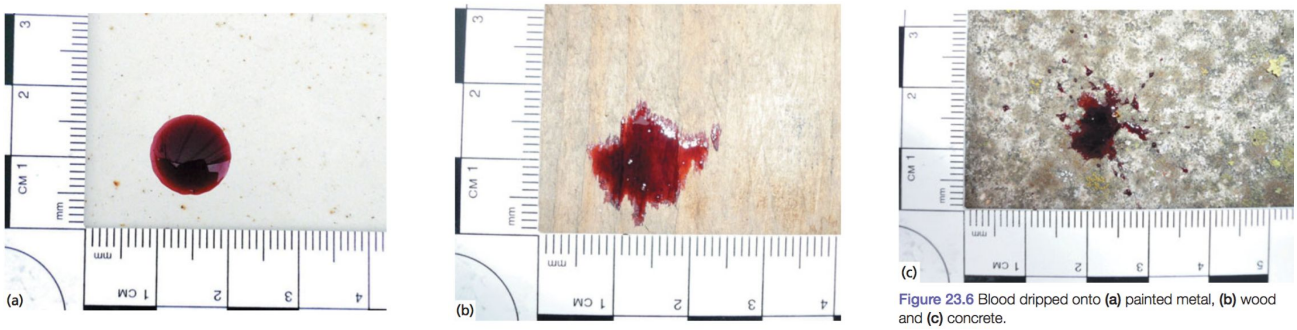


Figure 23.6 Blood dripped onto **(a)** painted metal, **(b)** wood and **(c)** concrete.

2- Contact Blood Staining

- Contact bloodstains are formed when a blood-stained item comes into contact with another, non-stained item.
- Contact smears are divided into **wipes** and **swipes**.
- If a surface is contacted, by a bloodstained hand, the resulting stain is a **swipe**.
- If a clean hand moves through blood staining on a surface, the resulting stain is termed a **wipe**.

Figure 23.7 A contact bloodstain created by a bloodstained hand touching a wall.

Blood Pattern Analysis

3- 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. 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.**
- The force made by the discharge of a firearm can create bloodstains so small they are termed misting
- Coughing or sneezing may create patterns similar to impact spatter if an individual has blood within their airways.

Figure 23.8 A typical impact spatter pattern. The source of wet blood was located at the centre of the bottom edge of the picture.

4- Cast Off

- Cast-off is formed when an item bearing blood staining is moved through the air with sufficient force to drive blood from its surface. **For example,** if an individual is repeatedly beaten with a baseball bat (Walking Dead), blood may gather on the face of the bat each time it is raised and lowered, and this blood may be driven off by centrifugal forces.
- The staining often in **line** .
- Knives and fists can also produce cast-off.

Figure 23.9 Cast-off blood patterns created when a baseball bat wet with blood was swung through the air.

Blood Pattern Analysis

5- Arterial Spuring

Figure 23.10 Projected blood pattern: arterial spurt/gush.

- When an artery is damaged (e.g. by a knife or blunt impact), blood is projected under high pressure, which does not happen with venous bleeding (the venous system being a low-pressure system).
- Blood projectile over some distance
- There are characteristic pattern of large stains and runs. There may also be a wave-like pattern to the stains because the pressure with which the blood is forced from the body reflects the pumping action of the heart.

6- Physically Altered Blood Strain

Figure 23.11 Blood mixed with another body fluid projected onto a wall. Note the dilute appearance.

- Bloodstains can be physically altered over time or by the addition of other body fluids.
- On occasion, injuries can be inflicted following a gap in time after an initial assault and blood may have begun to clot. Subsequent blows can result in unusual stains being observed.
- These may be an admixture of blood and mucus/saliva injuries are to the facial area.
- Other body fluids such as urine may affect the appearance of blood staining.

7- Luminol

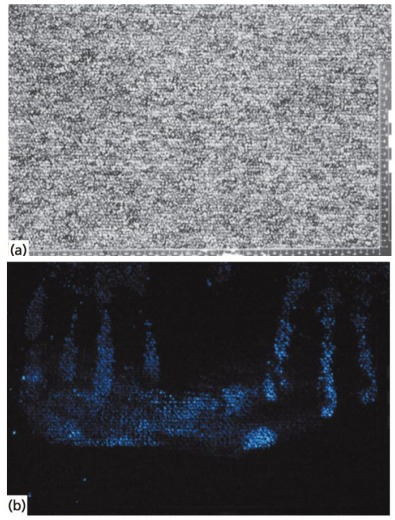


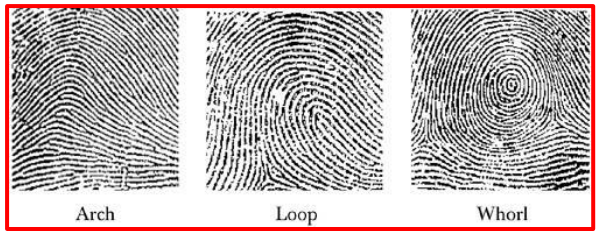
Figure 23.12 **(a)** A section of carpet with no blood staining visible. **(b)** The same section treated with luminol, revealing superimposed hand and footwear marks.

- If attempts have been made to clean away blood staining, the scientist can use chemical means to visualize staining that may have been present prior to those efforts.
- The use of luminol, a highly sensitive chemiluminescent compound can help the scientist visualize where blood staining had been present before any such cleaning efforts. It should be noted that the carrier for this chemical is primarily water so its use should be one of the final actions at a scene.

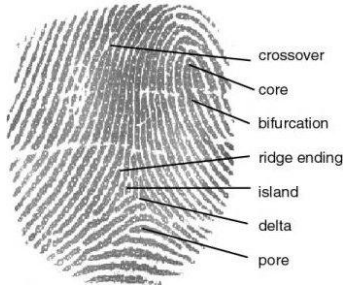
Damage

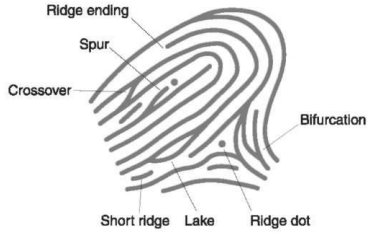
- When items are broken, it can be possible, by **visual** and **microscopic** examination, to tell whether or not two or more items are fragments of one original item; **for example,** the two broken halves of a plate. This is achieved by comparing both gross features as well as finer details. The more points of comparison that can be made, the stronger the opinion that can be offered
- By examining the edges and fibre damage to clothing items that have been torn or cut, it may be possible to comment on what type of damage actually occurred as in many cases where allegation of tearing occur, a cut has been used to start a tear. It is also possible to comment on how recently damage may have occurred.
- 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.

Fingerprint



- Fingerprints are formed within the womb at approximately 12 weeks of gestation and apart from damage by environmental factors, do not alter during one's lifetime.
- There are some particular patterns to be formed termed ridge ending, bifurcation, short ridge, spur, dot, bridge, lake or delta.
- As there are sweat glands within the ridges, an impression of these secretions can be left as a fingerprint on a surface **(latent marks) .**





...Continue Chapter 23

Continue … Fingerprint

Figure 23.14 A finger mark in blood left on the blade of a knife. The finger was wet with blood prior to touching the blade.

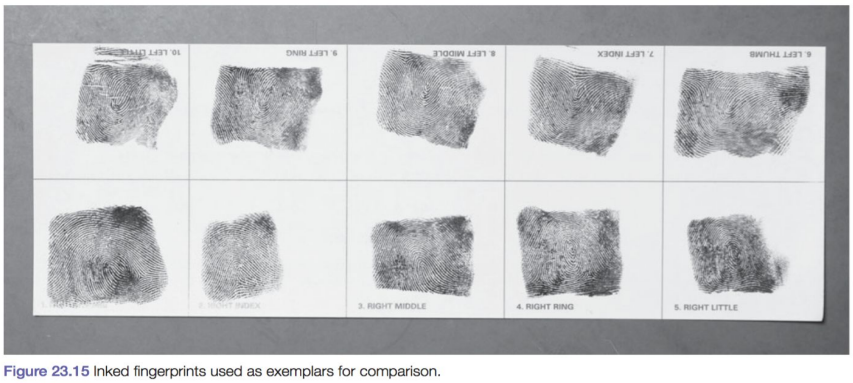


Figure 23.15 Inked fingerprints used as exemplars for comparison.

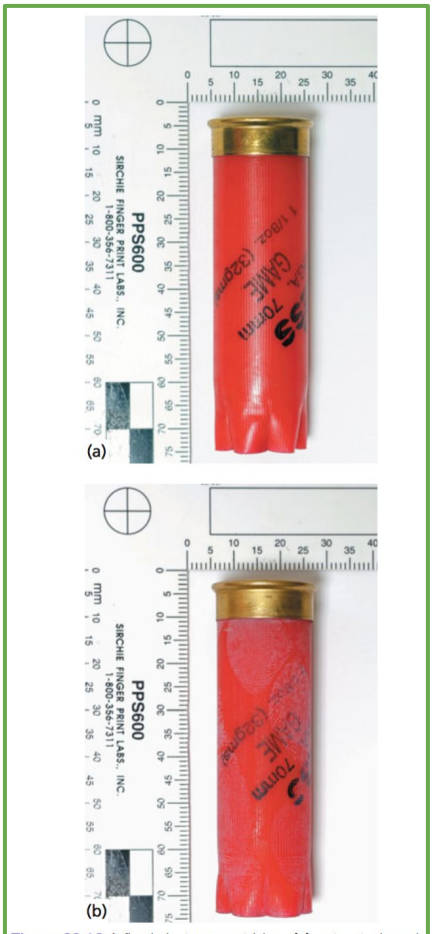


Figure 23.13 A fired shotgun cartridge: **(a)** untreated, and **(b)** treated with cyanoacrylate (superglue) fumes, revealing finger marks.

- It is often necessary to use specialized light or chemical enhancement on fingerprints so that all available parts of the mark can be seen. Different wavelengths of light and specialized chemicals are used to enhance the different compounds within the fingerprint (Figure 23.13).
- Fingerprints may also be left (patent marks) if there is a contaminant such as **ink**, **blood** or **paint** – **For example** on the finger before it makes contact with a surface. Another way of leaving a fingerprint is to make an impression into a surface, such as one coated with grease or blood (Figure 23.14).
- Databases of fingerprints are held on a card- based system using the **'Tenprint'** forms used to take inked fingerprints (Figure 23.15).

Footwear

Footwear Marks

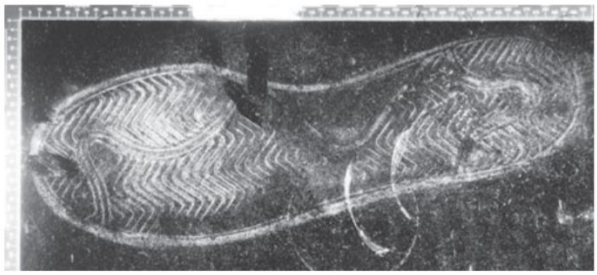


Figure 23.16 Recovered footwear mark showing damage features.

- **When people wearing footwear come into contact with a surface they often leave an impression**. The extent to which this occurs may depend on many factors, such as how dirty the sole of the shoe is or the floor surface itself. The resulting footwear impression can be photographed, lifted using a variety of media or it can be recovered whole (marks on paper for example) and submitted to a laboratory for a suitable method of enhancement
- To carry out a comparison of the recovered footwear marks with a suspect shoe, a test impression of the sole pattern is required. This can be prepared by brushing the sole with aluminium or black powder and then placing the shoe, sole side down, onto adhesive plastic. The plastic is then placed onto an acetate sheet and labelled to both identify the shoe but also ensure the correct orientation of the impression. This can then be laid over the photograph of the mark recovered from the crime scene and a comparison carried out.

Footwear Marks and Skin

When forceful contact is made directly to the surface of the skin, it is possible that patterned bruising may be left on the skin forming a mark characteristic of the surface that made the contact. In the instance of shoe marks the surface is often made up from regularly spaced components that may leave an impression matching the components. Alternatively, the pressure exerted during such a forceful contact may force blood in the surface of the skin into the gaps between the sole pattern components, leaving what is often referred to as a negative impression. The comparison of such marks with test impressions taken from the soles of shoes may be possible depending on which part of the body bears the impression. Forceful contact with skin that is close to a bone often carries a greater degree of detail. However as the surfaces are not flat they can often present a distorted impression that is difficult to compare. Photographic overlay techniques can be used to determine comparisons.

Trace Evidence

This type of evidence can include anything that has been transferred by means such as contact with a surface or a person and this is the practical application of **Locard's Exchange** Principle. Often the material is very small and requires microscopic examination.

1- Glass

- Glass is manufactured for use in construction by floating it on the surface of molten tin.
- When glass is broken, small fragments are showered into the surrounding area. If a person were near to the breaking glass it would be expected that some of these fragments would transfer to the individual.
- Glass fragments recovered in the laboratory or from assault victims and suspects can be compared with another source of glass by various means, including the measurement of their **refractive index** and **their chemical composition.**

2- Paint

- If damage is caused to a painted surface then small flakes can be transferred. In the case of road traffic collisions there may be a two-way transfer of material.
- Examine it by microscopic

3- Fibers

- Clothing and soft furnishings are made in a wide array of fabrics that come from all manner of sources.
- Identification of the fibres involves microscopic and analytical techniques and it is possible to use the results in tandem with the number and location of the recovered fibres to give an interpretation of the circumstances that caused the transfer to occur. For example, it may be possible to state in which seat of a car a suspect was sitting where their version of events does not fit the incident

Fire Investigation

- Fires are investigated by a wide range of professionals for a diverse range of objectives.
- The fire investigator will be concerned with determining the **'defect**, act or **omission'** that led to the fire to improve fire prevention.
- The forensic pathologist may be attempting to determine whether a body found within the fire scene had been assaulted or had died prior to the fire.
- Regardless of these objectives, all the investigators will be interested in determining two principal facts:
  1. The **origin** (or seat) of the fire must be determined, and
  2. Consideration of what may have started it.
- The more imprecise the area of origin then the more potential causes may have to be considered.
- All fires require a combination of **oxygen**, **fuel** and **heat**. Oxygen is normally freely available in air and fuel is provided by almost any material given the right conditions. The heat, initially, is provided by a source of ignition, such as from a lit match, cigarette or heating appliance.
- Once ignited, a fire spreads through a number of mechanisms. These include radiation (or direct flame impingement), convection (the movement of hot air currents) and conduction (the transfer of heat energy through a material).
- Two types of fire :
  1. **Smouldering combustion**
     - Typical examples of smouldering combustion include a lit cigarette or a barbeque
     - Can also be produced when the oxygen levels are reduced during burning, such as in a sealed room
     - Intense but quite localized burning patterns.
     - Spread by direct contact
  2. **Flaming combustion**
     - a garden bonfire would be described as an example of flaming combustion.
     - spread by a variety of mechanisms including direct flame impingement, radiation and convection.

Fire Investigation

- The rate of smouldering will vary depending on the nature of the materials involved.
- Smouldering fires can, however, transform into flaming fires and vice versa
- Several complementary methods are used to determine the origin of the fire. **As a general rule**, fires will tend to spread upwards and outwards. A good place to start, therefore, is by finding the lowest area of severe damage. Heat and flames are quite directional and will leave patterns of charring in some places and protected areas in others. All of these will assist in determining the origin of the fire also, The area of origin can be determined by scorch or char patterns,

- It may sometimes be necessary to determine the cause, or probable cause, by a process of **elimination**.
- There are some typical indications of a deliberate fire, such as multiple points of ignition, the use of a flammable liquid, a modified fuel load (e.g. the armchairs stacked on top of the sofa!) the presence of an incendiary device or timing mechanism. A deliberate act may also be inferred by indirect forensic evidence. The presence of a broken window at a point of entry, footwear or tool marks, a drop of blood or snagged fibres could all indicate a suspicious event.

Firearm

a **lethal** barrelled weapon of any description from which any shot, bullet or missile can be discharged

There are two main types of firearm:

1. those with s**mooth-bore barrels**, which usually fire groups of shot
2. those with **rifled barrels, which** usually fire single bullets.

Shotgun

- commonly used as sporting and farming weapons, & Smooth-borne firearm (many bullet) and it can reach to 30-50 m (usually don't kill in that range) that are used to discharge cartridges that usually contain a number of shot
- Name "slug" referred to a weapon who has cartridges contain one single heavy projectile.
- The types of wound produced by a shotgun will be dependent on the calibre, shot size and distance at which the shotgun was discharged from the target.

Rifled Firearm

- Fire one bullet
- Two main group : **Handguns** & **Rifles**.
- **Pistols** = semi-automatic hand gun
- **Revolves** = cylinder rotate

- **Rifles** are long-barrelled weapons that are designed to accurately fire projectiles at targets at a much greater distance than revolvers or pistols. Rifles have been designed to use many different types of operating mechanism, ranging from single shot bolt-action rifles to fully automatic gas-operated assault rifles, some of which are capable of firing in excess of 700 cartridges per minute.

Figure 23.19 A 9 × 19 mm Luger semi-automatic pistol cartridge (top), and a NATO 5.56 × 45 mm automatic rifle cartridge (bottom).

Firearm

Forensic scientists are able to **analyse the evidence that is generated** at the scene of a crime involving the discharge of a firearm. This includes projectile trajectory and range-of-fire determinations. These aid in the reconstruction of shooting scenes, and the **examination** of fired bullets and cartridge cases recovered from a crime scene can be used to compare the marks observed with those produced from the discharge of a firearm suspected to have been used in the crime. This information can then be entered into a firearms database that allows the **determination of links** between scenes at which the same firearm may have been used and to establish gun crime trends, both nationally and internationally.

In addition, forensic scientists can use specialist equipment to determine the velocity and kinetic energy of a projectile in flight, which can be used to establish the ballistic performance of a projectile and the lethality of a weapon/ammunition combination. In the UK this is routinely used to determine if air weapons have lethal potential or are especially dangerous according to current UK firearms legislation.

Chapter 24

Allied Forensic Specialties

Before you start this chapter I tried my best to make it story based with some examples created to be look like a detective series TV and I re write what's in the book in an understandable language using some arabic words wish you the best <3

Note: whenever you read the word "evidence" it's mean in forensic the thing that will be used to prove a crime! Not just an explanation

Introduction

Forensic medicine and science are supported by, and to some extent include other medical, quasi-medical and scientific disciplines each of which may have a significant and often principal role in forensic casework. Investigators should be aware of the range of these disciplines and ensure that the skills and expertise of all appropriately trained practitioners and their specialties are used to their optimum extent. Examples of such specialties, some of which are referred to in earlier chapters are **out- lined below.**

Forensic Ecology

is the **use of environmental** evidence types to assist in investigating crime, both outdoors and indoors.

1. Diatomology

diatoms are **algae(طحلب)**, microscopic unicellular plants, which can be found in saltwater, freshwater, soils and **damp(مبلل)** surfaces.

- They are very diverse with over 100 000 species known. They have a unique **silica cell wall called a frustule** which makes them very strong and allows them to resist harsh conditions.
- As they are classed as algae, they rely on the sun for their energy and as such are found in well-lit surface layers of water. When diatoms die, their skeletons **sink to the bottom layers of water.**
- **باختصار الطحالب هذي تعتبر نبات والنبات يحتاج ضوء عشان كذا تعيش على سطح المياه ،فإذا ماتت يتكسر الجدار الخلوي تبعها ويغوص الى درجات اعمق**

The Question is WHY THE H*LL WE STUDY ALGAE IN FORENSIC ??

- **The answer for this Q is interesting because these tiny algae is the thing that helps us to know if the victim (الضحية) die because of drowning due to inability to swim or the victim has been killed somewhere away from the water and the killer throw it to the water to make the police thinks it's normal drowning.**
- **The mechanism for the above is (اقراه زين وتخيل انك طحلب): The presence or absence of diatoms within the body can assist in such an investigation. When water has been inhaled into the lungs (and this can be as much as 250 mL), any diatoms present may enter the bloodstream via the lung parenchyma and then The heart continues to pump circulating diatoms around the body to all organs. The presence of diatoms within the body suggests that the person was alive when they entered the water and that drowning was the cause of death or played a significant part in the cause of death.**
- **Diatoms can't pass through GIT to bloodstream**

Forensic Ecology

2. Forensic **palynology**

palynology uses analysis of pollen(حبوب اللقاح او غبار الطلع), spores and other microscopic particles.

An example of this : **Pollen grains** are produced by seed-bearing plants(نبات حامل للبذور), flowering plants and cone-bearing non-flowering plants est..Palynology also comprises the study of other microscopic entities such as insect and plant remains, particularly micro-charcoal (microscopic particles of charred plant material). Collectively these are referred to as palynomorphs.Pollen is seasonally and geographically sensitive and may be dispersed by water, wind and insect activity throughout the year.It settles on surfaces in much the same way as **dust** and is invisible to the **naked eye.**

Again >> **WHY THE H*LL WE STUDY Pollen IN FORENSIC ??**

The answer for this Q is because these dust-like particles is moving ! which mean it can transferred from one surface to another an example of that : we know a certain plant in a certain geographical area has a special type of pollen which appear in a certain season

Let me say it again in a different way : we found a body of a dead person in riyadh which were in clothes with X pollen usually from a plant normally seen in Majma normally appear in summer season

Now Mr officer tell me this victim : from where and when this crime happen ? and if we found a witness in the crime scene carry the same X pollen in his back-up car what does that mean? I will leave you with your own answer because the idea behind this story is just to tell you how strange people in forensic work :(

Forensic Ecology

2. Forensic **palynology**

You know now the benefits of this field in forensic the rest is تحصيل حاصل

pollen may be collected on shoes, clothing and tyres, for example, when in contact with soils and vegetation. In addition, airborne pollen collects in the nasal cavities as one breathes. An experienced palynologist can identify individual pollen grains and spores and reconstruct a habitat from a pollen assemblage of samples collected. Pollen evidence can be used to:

- Link people, vehicles, and objects to a known scene or deposition site;
- Identify habitats or geographical locations relevant to police investigations;
- Prove or disprove **alibis(الاعذار)**;
- Help determine the fate of an individual prior to death;
- Assist in determining the season and location in which an individual died;
- Help determine possible locations of a missing person by looking at the clothing of a suspected offender;
- Assist in determining the country of origin of illicit drugs.

Forensic Ecology

3. Forensic **entomology**

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**,beetles

- **Blowflies** are especially useful to the investigator as they are most often the first invaders of **decomposing (الجثة اللي جالسة تتحلل)**material(**dead body** for instance)
- In **warmer temperatures,** blowflies can begin laying eggs on a body within a few hours of death. When temperatures are cooler, or if the body is **concealed(اخفاء الجثة في مكان بارد)**, such behaviour(*decomposing*) may be delayed or impeded.
- In cases where a body is enclosed, for example within a container or in a grave, blowfly access may be prevented due to the physical size of the flies. Under these circumstances, **other, smaller flies** may be the first to commence egg–laying.
- Again … WHY TH.. Just jokin :)
- As you can see these flies can lay there egg on a dead decomposing body, this can help us know if we found a body in a grave or in a hidden place Buried underground, and these eggs can help us answer the following answer :

    1. Is the body killed and **immediately buried** underground **(so we will not find the blowflies eggs as there is no time to laying their eggs in the body)**
    2. Is the body killed somewhere else and got buried **after 8 hours** (**so when we extract the body and send it to the lap we will find these eggs so we confirm that the body killed somewhere else and took time to reach the grave**)
    3. Or we found a body we know already it's killed somewhere else but when we found it, we couldn't find the blowflies eggs **(which mean the killer put the body in a cold condition to prevent that process from happening as the blowflies can't tolerate the cold condition)**

Insect analysis (entomology) can assist in providing information about:

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

Now we've done with the forensic ecology and its subspecialties. The other speciality include :

2. **Forensic archaeology(study of what remain!):** 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(study of body bones!)**: 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(discussed below).

4. **Forensic odontology(dentistry)**: 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 antemortem information about the individual or relate such information to known published population data.

5. **Forensic photography(see the unseen!)**: 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.

Thank you