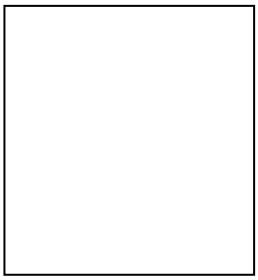
Practical Notes
In Veterinary Forensic Medicine

Contents

Student activities in Veterinary Forensic Medicine



Student name	
Student Number	
Section Number	

Title (Subject)	Date	Grade	Supervisor signature
Fundamentals of Animal Abuse			
Forensic Examination and Necropsy Protocol			
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Examination of Hair and Fibers			
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1 Fundamentals of Animal Abuse

Introduction

Forensics is the use of science to answer questions posed by courts of law. Thus, for as long as there have been veterinarians, there has been veterinary forensics, in which veterinary knowledge is applied to legal questions. Similarly, veterinary pathologists have been asked questions in courts of law since the inception of the college; therefore, the practice of veterinary forensic pathology (VFP) is equally old, if unrecognized. Cases involving insured animals, possible medical malpractice, and alleged animal abuse and neglect (AAN) are not new. What is new is the increasing amount of media coverage and degree of public awareness of these cases, and at least 1 veterinary diagnostic laboratory has documented an increase in the number of cases of companion AAN submitted for necropsy. While the notion that cruelty to animals is a symptom of depravity predates sociological studies, there has been a recent global increase in the enforcement of laws regarding animal care and the enactment of tougher laws regarding animal abuse and neglect. One driving force behind this change has been the affirmation of the link between animal abuse and various types of interpersonal violence, including child abuse, domestic violence, rape, robbery, and homicide. Animal abuse at a young age appears to be predictive of later interpersonal violence and there is strong evidence that individuals are often violent toward animals and people concurrently. Definitions of and criteria for animal abuse and neglect vary among jurisdictions, countries, and cultures. However, in general, animal abuse is an act of commission and gives satisfaction to the perpetrator. Animal abuse is often legally

defined as gross neglect, physical trauma, sexual abuse, hoarding, cockfighting, or dog fighting. In contrast, animal neglect occurs when a

person deprives an animal of food, water, shelter, or veterinary care and is frequently an act of omission stemming from ignorance.

Changes in laws and their enforcement have created a demand for forensic veterinarians (FVs), who possess a special combination of knowledge and skills. They are familiar with laws concerning animals in their jurisdiction and are points of contact for law enforcement officers when cases of suspected AAN occur. They simultaneously care for the injured or debilitated while documenting their condition and collecting evidence. They may have some training in crime scene investigation (eg, blood splatter analysis, DNA collection). FVs may conduct all or part of a postmortem investigation, including the necropsy, consulting with specialists, and referring samples as needed. Finally, FVs tie together all information garnered from the postmortem investigation, witness statements, crime scene analyses, and so on; compose a final report for use in court; and prepare to testify.

Classification of abuse

Confusion frequently surrounds the words ‘animal abuse, because they are used to encompass a great variety of circumstances. In addition, other terms, such as ‘animal cruelty’, ‘maltreatment’ or ‘ill treatment’ are also widespread. Veterinarians are aware (sometimes uneasily) that a further complication lies in the fact that the question of whether a situation or act involving an animal is judged ‘abusive’ also depends on the views that human society holds on *particular groups* of animals. For example, attitudes on what is accepted as tolerable regarding the husbandry and slaughter of farm livestock, the trapping and poisoning of animal

‘vermin’, and the use of laboratory animals in scientific research are quite different from what would be regarded as acceptable in the family pets. In

other words, treatment that is commonly tolerated in one group of animals might well be considered ‘abusive’ in another. However, in *companion animals*, confusion can easily and simply be avoided by applying the tried and tested typology developed successfully by the medical profession for *child abuse*. It can also be used in *appropriate* cases in all other animal groups.

1- Physical abuse Synonyms

The perpetrator of physical abuse subjects the animal to a variety of actions that cause bodily injury. In some cases the fact that deliberate physical abuse has taken place is perfectly clear. A man witnessed beating his dog to death with a hammer would be such an instance. In others it is much less straightforward, and therefore can be much more difficult to recognize and diagnose.

2- Sexual abuse

This means the use of an animal for sexual gratification. The term ‘a*nimal sexual abuse’* is preferable to the more familiar ‘*bestiality*’ or ‘*zoophilia*’, both of which focus primarily on the perpetrator, and thus fail to convey any sense of the physical harm that may occur to the animal.

It is the very fact that the abuse involves the sexual organs or anus/rectum that distinguishes the abuse as sexual in nature. Physical injury to animals (or birds) of either sex may result and, depending on the actual type of sexual act carried out, and the size of the animal, can be very severe.

3- Emotional abuse

Although some might claim that animals have no emotions, and therefore cannot be emotionally abused, it is difficult to believe that veterinarians and animal behavior specialists would agree. For example, regular threatening behavior and verbal harassment of the animal (shouts, angry

gestures), or a failure to provide psychological comfort, clearly constitute emotional abuse. However, neither author of this textbook makes any claim to expertise in this area, belonging as it does to the realm of specialists in animal behaviour. It is therefore not a subject of discussion here.

4- Neglect

This simply means a failure to provide the animal with the basic physical necessities of life: food, water and shelter. It also includes failure to seek veterinary attention for injury *and* for naturally occurring illness. Failure to provide veterinary attention in cases of natural illness is neglectful and falls within the definition of abuse. Abandonment of an animal is a clear example of neglect, as is the all too common practice of allowing a collar to tighten and constrict the neck of a growing animal. Both men and women neglect animals, and it is common in all animal groups.

Intentional and non-intentional abuse

The law with regard to animals varies from country to country, and in some countries abuse is subdivided into *intentional* and *non-intentional*. This is not the case in Great Britain, because in both English and Scots law a lack of 'intention' to abuse is irrelevant under animal welfare legislation. In other words, it is not a defense for a person to claim that they did not intend to cause harm, or were unaware of the animal's needs.

The factor taken into account by a Court of Law when judging a case is what a reasonable person would have done in the particular circumstances of that case.

Animal abuse and the veterinary personality

Veterinarians tend in the main to be of the tender-hearted variety, caring deeply for the welfare of their animal patients but also frequently feeling compassion for the animals' owners. In addition, they mostly work independently, are accustomed to carry heavy responsibilities, and are recognized in their communities as persons of standing. All of these factors mean that it can be very easy for them to err by stepping outside their particular area of expertise (the veterinary one) when dealing with abused animals and their owners, and thus rationalize that particular circumstances mean that the perpetrators simply did not *intend* to be abusive. For example, they may consider that plain and simple ignorance of the needs of the animal has resulted in neglect. Or they may be aware that the owner has a particularly stressful home environment, and can therefore be excused a certain amount of violence towards a pet who has further stressed them by 'inappropriate elimination' in the home. In the fi rst scenario, good advice may eliminate the problem, although this clearly depends on the level of neglect involved. In the violent scenario, it is unacceptable for the veterinarian to take it upon themselves to act as judge and jury when presented with any animal that has been injured deliberately. Veterinarians need, therefore, to remember that their primary responsibility is to the animal. They can also be reassured that it is not their responsibility to *prove* abuse (of any type), because their responsibility is solely to provide relevant veterinary evidence. The final decision is not a veterinary one, but belongs to the Law Courts, where *all* the evidence and circumstances of the case are considered.

The link between violence to animals and violence to people

Evidence, albeit sometimes decried as anecdotal, that there is a link between violence to animals and violence to people has been growing for some years. In 1994 Arkow wrote that veterinarians have an important role to play, because they see and treat abused animals. Further, he considered that not only do veterinarians have an ethical responsibility to the animal but also a wider social responsibility '*to take a leadership role in preventing abusive interrelations*'. Hutton, in 1983, suggested that evidence of abuse (of all types) in the family pet might be a useful piece of intelligence for early identification of abuse in other members of the family. Gillham (1994) underlined the particular difficulty in predicting and preventing fatal child abuse. Child protection personnel who become aware that family pets are being abused – and are prepared to include its existence in assessments – may find it a useful and rewarding piece of 'early intelligence'. Nevertheless, to be able to use animal abuse as an indicator requires the ability to recognize and identify the abuse. This may seem simple in cases of abuse by neglect. A thin, malnourished dog, for example, may be visible outside the home or seen by visitors. But the situation with regard to recognition of *non-accidental injury* can be much more complex. Veterinarians in particular have invariably felt that they were in a difficult and uncomfortable situation when they suspected deliberate injury in a patient because, unlike the medical profession, the knowledge to help to differentiate the purely accidental injury from deliberate injury was simply not available.

A horse that cannot stand on its feet being beaten countless times by owner with a whip

Bull dying in a bullfight

2 Forensic Examination and Necropsy Protocol

a) Safety measures

Use coveralls, facial masks, protective glasses, rubber gloves, and rubber boots. If carcass was covered with tarp, handle with care and wait for a while for the carcass to ventilate before touching it. Use sharp, clean, if possible sterile instruments.

b) History

Before starting the necropsy itself, detailed information on circumstances in which the death occurred need to be taken. These include, owner's name and address, individual identification (species, breed, age, sex, hair color, tag number, marks, weight, etc.), number of animals in the herd and management practices, feeding, vaccination history, Herd health, morbidity and mortality, description of clinical signs (if available) or health history of the dead animal, date/time when the animal was last observed before death and condition at that time, date/time when the death occurred (if known) or when the animal was discovered, location and geographical characteristics of the property and the place where the animal was found (pasture, barn, etc.), distance from roads, highways, localities, neighboring farms, waters, wooded areas, etc.), previous similar occurrences on the premises and/or the proximity and weather conditions at the time when the death presumably happened and during the time until the carcass was discovered.

c) External examination

Immediate environment: soil, vegetation, presence of preagonic struggle signs, body and body parts position, nutritional condition, integrity of the

body (missing body parts, description), hair coat condition (uniformity, presence of swellings, fractures, parasites, lesions and/or foreign materials), natural orifices (buccal, nasal, rectal, vaginal, preputial, ears), apparent mucosa (conjunctival, buccal, nasal, vaginal rectal preputial), with special emphasize on color and texture, discharges (nasal, bucal, vaginal, etc) and post-mortem changes (rigor mortis), odors emanating from the carcass and/or surroundings, foreign materials on the body (powders, leaves, grass, soil, etc), body temperature, compared to the outside conditions

d) Necropsy

- Place the animal in left lateral recumbency, if possible with the back higher than the ventrum. This position allows the removal of the smaller abdominal viscera without disturbing the lower and larger organs.
- Incise the skin along the ventral mid-line, from the chin to the anus. Cut above the sheath or mammary gland and from the inner to the outer side of the skin. Reflect dorsally the skin and both limbs of the right side. Disarticulate the right limb at the femoral joint. Upon completion both limbs will be at right angles to and above the back.
- The abdomen should be opened and explored before opening the thorax. Cut into the abdomen below the tuber coxae.
- Avoid puncturing the intestine. Extend the incision anteriorly ventral to the lumbar area to the ribs. Continue the incision posteriorly and ventrally to the mid-line and then anteriorly toward the xiphoid cartilage. Observe the amount and aspect of the abdominal fluid, the topography of the internal organs.

- Presence of abnormal materials (food, parasites, etc). It may be advisable to take samples for culture at this time since further manipulation will soon induce contamination.
- Make a small incision in the diaphragm and listen to determine if there is a negative pressure in the thorax. With orchard (bone) shears, ax or cleaver, cut the ribs from behind forward, staying ventral to longissimus dorsi muscle.
- After lightly incising the right costo-chondral junctions on their medial aspect reflect the ribs and the right abdominal wall ventrally until the costo-chondral junctions are fractured and the body wall remains in a ventrally reflected position. Alternatively the thoracic may well be removed.
- Remove the omentum after cutting it close to visible attachments. Palpate between the reticulum and diaphragm for adhesions or penetrating foreign bodies. In cows remove the mammary gland and supra mammary lymph nodes and examine them.
- Remove the right adrenal, which is adjacent and posterior to the liver and anterior to the right kidney. Strongly reflect the right kidney and its perirenal fat posteriorly while the renal artery and vein on the anteromedial aspect are cut. The ureter will remain attached and should be stripped out back to the urinary bladder.
- Transect the duodenum on each side of the entrance of the bile duct leaving a few inches of the duodenum attached to the bile duct. Examine the pancreas, which is posterodorsal to the same area.
- Transect the colon at the pelvic inlet. The while pulling the end ventrally, transect its mesentery. Then grasp the entire mass of intestines, pull them anteroventrally and transect the mesenteric attachment as far as possible and remove the mass of intestines.

- Cut the mesentery from the small intestine close to its line of attachment to so that the small intestine lays straight and can be opened longitudinally along the line of mesenteric attachment. The ansa spirals can be unwound as double fold starting at the center of the ansa; alternatively it can be opened and examined in situ.
- Remove the left adrenal, left kidney and attached ureter.
- Remove the fore stomachs, rumen and spleen as a single mass. The process is facilitated by strong antero-ventral traction by an assistant while the dorsal attachment and esophagus are transected. After removal, separate the spleen from the rumen and examine it.
- Transect the reticulo-omasal junction, separating the omasum and abomasum from the rumen and reticulum . Beginning from behind, incise the rumen and reticulum on the mid-dorsal line. Examine and remove the contents.
- Wash the rumen out using cold running water. Remove the omentum from the abomasum and incise the abomasum along its lesser curvature. Extend the cut through the omasal sulcus Examine and remove the contents and wash out both structures with cold water.
- Remove together the diaphragm, the attached liver and all possible posterior vena cava. This is most easily accomplished if the thoracic viscera has been removed previously; if not, those structures that penetrate the diaphragm on its anterior aspect must first be transected.
- Saw across the shaft of the right ileum just anterior to the acetabulum. Saw through the symphysis of the pubis. Open the right side of the pelvis. Remove as a mass the rectum, genitalia and bladder. After separating the rectum and anus, open all the

- structures removed. In female it is important to completely open the entire genital tract and examine all the components and the content of different cavities (uterine, vaginal). In males, next remove the sheath, penis and testes and examine those.
- After transecting the attachments of the tongue to the mandible retract the tongue (it may be helpful to split the mandibular symphysis). Disarticulate the hyoid at the middle cornua. Then retract the tongue, larynx, trachea and esophagus into the thoracic inlet by cutting all soft tissue attachments. While lifting on the esophagus and trachea, incise the mediastinum dorsal to the aorta, the sternal attachment of the pericardium (avoid cutting into the pericardial sac). In front of the diaphragm transect the structures that penetrate it and then remove the lungs and all attached organs and structures.
- Lay the lungs on a table with the tongue to the right. Palpate the lungs deeply to detect lesions not grossly visible on the surface. Open the esophagus longitudinally and then remove it. Examine the thyroid glands and parathyroids. Examine and incise all lymph nodes.
- Open the larynx and trachea. After separating the left and right lungs from the heart and mediastinum, open the pulmonary veins, pulmonary arteries, and major bronchi. Incise, examine and remove the pericardium noting the characteristics of the pericardial fluid. Examine the heart and aorta. In opening the heart use the technique described elsewhere in this manual.
- Skin the head and then disarticulate it at the atlanto-occipital joint. Remove the brain. After splitting the mandibular symphysis, split or saw the head longitudinally along its median line and while

viewing its ventral aspect. Remove the nasal septum. Examine the turbinates and the teeth. Chop or saw across each half of the head to examine the maxillary sinuses.

- Remove the spinal cord. Muscles, bones and joints are examined after removal of the hide and careful dissection of the pertinent part.
- After completing the necropsy, all organs and debris are placed in the body cavity. The right body wall and limbs are returned to their normal position and the mid-line skin incision is laced together with heavy cord or wire. (If the necropsy is conducted in the field).

e) Record all necropsy findings in writing:

Lesions and different changes (dimensions, color, consistency, and relations with neighboring tissues and organs) need to be described in detail so that they support the gross pathology diagnosis and help additional investigations by other
means.

f) Sample collection

Collect proper samples for laboratory analysis (fresh tissues for bacteriology, virology and toxicology) and tissues fixed in 10% buffered formaldehyde solution, for histology). See Sample collection protocol.

g) Post-necropsy

- Decontaminate instruments before cleaning them.
- Clean and disinfect all work surfaces.
- Decontaminate self (e.g., disinfect and remove boots, gloves, and coveralls).
- Record the necropsy findings.

Necropsy equipment

Samples

Samples

Samples

Samples

Case Report (1)

Case Report (2)

Case Report (3)

Case Report (4)

3 Animal Identification

Introduction

It means recognition of an unknown animal whether living, dead or body remains. It is important in case of differentiation of individual animal from other, meat adulteration, criminal cases and in cases of medico legal reports and law courts. It includes identification of, living animals, dead animals, body remains and meat and meat products of different animals.

In case of animal identification a detailed examination of the body must be made. The external inspection should be made in daylight. A note should be taken of the exact position and attitude especially if the animal body is seen where first discovered. Any sign of a struggle of footprints to or from body, any bottle of medicines, pesticides, or paints, vomits or excreta near the body (collected and retained) should be noted. The presence of wounds and or vital reactions, bruises or old united fractures should be noted. The extent of rigidity and putrefaction, warts, scars, tattoos and any abnormalities etc. In females, the condition of external genitalia of female must be examined for, signs of pregnancy and signs of abortion especially in case of criminal abortion. In newly born animal, the body should be thoroughly examined both externally and internally to identify live or dead and macerated fetus. A thorough and complete postmortem examination must be adopted in dead animals.

I- Identification of Living Animal

It depends upon, general features of animal, birthmarks and congenital deformities or abnormalities, age, sex, and tattoo marks, scars, and examination of hair.

1- General features of an animal

These are usually fixed and are very important in identification, e.g. species, breed, color, stature, age and characteristic marks on the body (head, neck, limbs, body and tail).

Muzzle (mouth) print

It is a new method adopted for identification of animals especially equines and cattle. Staining the mouth area or muzzle by special ink. The prints were developed in sensitive paper. Examine the print using magnifying hand lens. The dermal measurements of muzzle or mouth were recorded and photographed. Examine the mouth diameter, by designing a triangle from the left to the right portsides in the upper lip and the third angle on the lower lip. The distance, the height, the angle and areas of triangle were recorded. All the measurements and the dermal prints are completely differed from animals to another on the same species according to the age and sex.

Eye-prints (Iris recognition)

Iris recognition relies on the fact that no two irises are identical even when they belong to the same person. There are 6 billion people in this world and therefore 12 billion different irises. They always use the right eye for testing. UNHCR officials shine a special red light into the eye and take photos with a narrow angle lens. The image is fed into a computer,

which processes the information in the iris and converts it into a randomly generated number assigned to that person. The computer measures the specific structure of nerves and muscles, all things you can see in the eye. The iris is very rich in texture and very stable over time, so it's an ideal means of identification. The project inevitably ran into problems like cataracts and eye diseases, which kept officials from taking clear picture.

2- Birth marks, hereditary and congenital deformities

Birthmarks like moles and warts. These are always permanent and can't be removed except by operation or application of caustics and both of which leave permanent scars at the site of the mark or may leave irregular cicatrices of the surface which detected in oblique light with the aid of a good lens. Congenital abnormalities, as abnormality of limbs, hair, lips, cleft palate and hernia etc. Hereditary marks, as absence of ear in sheep, absence of tail in horse and short limbs in sheep and horse are the most famous examples. These marks should be clearly noted and described as regards their character, size and position.

3- Animal age determination

Estimation of age has got a very important bearing in legal problems of identification. It could be found out by examination of the teeth, individual bones, the ossified centers and the epiphyses unions.

Centers of Ossification

Bone	Site	Time Of Ossification (month)		
		Horse	Cattle	Dog
Scapula	Tuber scapulae + coracoid's process	12	7-10	6-8
Humerus	Upper extremity	42	42-48	12
	Lower extremity	18	18	7-8
Radius	Upper extremity	18	24	6-8
	Lower extremity	36-60	24	16-18
Ulna	Olecranon process	42	24	15
Femur	Upper extremity	42-60	36-60	18
	Lower extremity	42-60	36-60	18
Tibia	Upper extremity	36-60	42-48	18
	Lower extremity	24	24-30	14-16
Fibula	Upper extremity	Early	22-24	12

4- Animal sex

Identification of sex is usually easy in living and dead animals from the external genitalia. It takes place from buccal smear by the presence of the Barr body in female cells (sex chromatin test in human mainly). The presence of uterus, udder or the prostate is helpful in case of advanced putrefaction. In case of complete skeleton, from the shape of the skull, pelvis and size of long bones. If only few bones are present, one can tell the sex from the skull and pelvis with some degree of precision but the other bones it may be difficult to form more than a possible idea.

5- Artificial permanent marks

a) Tattoo marks

They are important permanent marks usually made by the introduction of particles of an insoluble coloring materials as carbon, aniline dyes and china ink under the epidermis of the skin of ear, nose or neck etc. by continues pricking of the skin with needles and this coloring materials are fixed inside the histiocytes and so cant be removed except after destruction of the epidermis. The permanency of the tattoo depends on the type of the substances used, its solubility and the depth to which it has been introduced under the skin. The tattoo, marks are artificially removed by the application of caustic substances (acetic acid, nitric acid, potassium permanganate, potash, hydrochloric acid or carbon dioxide snow) or by surgical operations in both cases a permanent scar is left at the site of the tattoo. Tattoo marks are commonest amongst animals grazing in meadows by different diagrams at different sites of the animals to be easily differentiated from other. Tuberculin test, animal insurance, artificial insemination bulls, diseased animals for their control, and in export and import animals.

b) Artificial marks like tattoo

- Tattooing using liquid nitrogen (freeze numbering), a new method is used in horse. This process is carried out at (– 80 °C) by special apparatus.
- Ironing (firing), a permanent mark used mainly in camels and cattle. It is applied on the horn of cattle and on neck, chest and thigh of camels. Firing marks often indicate the owner and or the grazing area of the animal.

a) Scars

These are connective tissues devoid of hair follicles, sweat glands and sebaceous glands but slightly vascular. They are formed as a result of the healing process of any skin wound, burn, disease or surgical operation affected the whole thickness of the epidermis. Examination of scars should always be examined in daylight. Note the number, shape, size, situation, direction and color of scars and If scar is movable or not, painful or not. In old scars, rubbing the suspected area by the hand or by application of a hot foment, the normal skin will become reddened, then the scar retaining its pale color.

Medico-legal importance

1- Identification of the live and dead animals.

2- One can usually judge the causal agent from the shape and the site of this scar as, in case of incised wound leaves a thin linear scar more or less depressed below the surface of the skin. Lacerated wound leaves an irregular broad scar, which may be depressed and puckered. Stab and puncture wounds leave irregular, circular, triangular or oblong scars.

3- It is difficult to tell the exact age of scar. The variations in the time of healing of wounds in animals are so great that it is not possible to fix any time limit within which these reparative changes are produced. Red and sensitive scar up to one month. Brown and coppery but not contracted from two to six months. White and contracted at six months or more.

6- Temporary marks *The usual temporary marks used in animals are painting in sheep, metal rings in birds and plastic marks in cattle, which indicate the insurance and Vaccination State of the animal.*

II- Identification of Dead Animals

1- External examination of macerated dead fetus

Evident signs of maceration appear in fetuses dying in uterus as short as few days before delivery in the form of characteristic rancid smell of the body, are characteristic rancid smell of the body, brownish discoloration of the skin and blistering or peeling of epidermis together with softness and flattening of the body so that it flattens out when placed on the table.

2- Live or dead birth identification

Evidences of respiration, changes in gastrointestinal tract, changes in the umbilical cord and changes in the cardiovascular system may prove live birth:

A. Evidences of respiration

It is the most important of the live birth identification which include, macroscopical evidences, floating test, static test and microscopical examination.

a) Macroscopical evidences

Non respired lung	Respired lung
Small , lie in the posterior of the thoracic cavity on the either sides of the vertebral column	Large, cover the heart and thymus
Has sharp borders	Has round borders
Has liver like consistency and color.	Has spongy and crepitate with light red color and mottled (mosaic).

b) Floating test

- Lung is cut into small pieces and placed in basin of water. All parts of the lung sink mean no respiration. All parts of the lung float means complete respiration
- Half-and-half means incomplete respiration. The respired lung may sink if affected by atelectasis or by consolidation due to pneumonia and microscopically will however easily distinguish these conditions.
- The non-respired lung may float due to the presence of putrefactive gases in the inter-alveolar spaces and this can be avoided by pressing the small pieces of lung tissues (by foot) in a piece of gauze to expel the putrefaction gases but not the gases of respiration so the lungs will sink when replaced in the water.

c) Static test

The ratio of the fetus lung weight to the body weight is 1:70 in the non respired lung and is 1:35 in respired lung.

d) Microscopical examination

The alveoli are lined with columnar epithelium in case of non respired lung but The epithelium becomes flattened due to distention of the air vesicles in case of respired lung.

B. Changes in the gastrointestinal tract

It includes stomach bowel floatation test and changes of the stomach

Changes of the stomach

The presence of colostrum or milk curdles in the stomach of newly born animal means that it has suckled the milk from the mother.

Stomach bowel floatation test

In the newly born animals and during the process of respiration air is swallowed in the stomach and gradually extends down the intestine. Tying double ligatures at each end (cardiac and pyloric). The stomach is removed from the body. Cutting inbetween these ligatures. This also done on several parts of the intestine were put in water basin. If the stomach floats this means that respiration took place for two hours before death. If the duodenum and upper part of intestine float, this means that the newly born animal has lived for 3-4 hours. If the entire length of the small intestines floats this means survival for five - eight hours. If the large intestine floats this means survival for 10-12 hours.

Changes in the umbilical cord stump and vessels

A dry clot obliterates the umbilical vessels after one hour of birth. The lumen of the vessels start to shrink and becomes star shaped in

few hours. Organization of the clot occurs after one week. The lumen completely disappears in six weeks.

Changes in the cardiovascular system

Through changes take place in the umbilical vessels and cardiovascular system we can determine age of newly born. Foramen oval, which closes after one week, but this may be however delayed for two or even three months and in some cases may not occur at all.

III- Identification of Animal Remains:

Identification of animal remain is usually the task of the medical Jurist. The animal remains are all or some of bones, muscles, fat, teeth, hoofs, claws or hair. The medical jurist should include the following points in his report when he is asked to identify a skeleton or a part or we must answer: Are the examined remains of animal origin?

1- DNA Profiles

DNA profiles are a new tool has been developed in Forensic investigation. It is a very important confirmatory genetic test as the DNA profiles is so great in statistical terms so it is reliably specific to any individual. **DNA** is the appreviation of Deoxy ribonucleic acid and it is the genetic material, which is confined in the nucleus of all nucleated cells. It contains the basic unit of inheritance called gene. Each DNA molecule is formed of two strands of nucleotides, which are connected together by phosphodiester bonds. Nucleotides are consists of a sugar, phosphates and a base. Million of these nucleotides form a single strand and despite these millions of nucleotides only four different bases are used, two of these are purine (adenine and guanine) and two are pyrimidine (thymine and cytosine).The two strands are complementary to

each other, which means that when adenine occurs on strand the complementary thymine occur in the other strand, similar guanine with cytosine.Genes are sequences within the DNA molecule separated by non coding areas, the function of which is still unknown (the gene itself is formed of coding are called exons which code for certain protein and non coding areas called introns.

Principles of DNA

Because of the millions of nucleotides forming a single strand and the fact that these are 23 pairs of chromosomes in each cell, these are almost a great variety in the arrangement of the nucleotides. The orders of sequence of the bases in the DNA molecule form a code of the genetic information of the cell. Only 10% of the molecule is used for genetic coding (the genes), the remainder being silent. Only uni-ovular twins have the same sequences.The chance of two unrelated individuals showing the same sequences was one in million billion. **Samples,** live tissue or blood samples fresh or stored frozen solid at - 20 C◦. Marked putrefactive changes, sufficient to destroy nuclear chromatin destroys the sample.

The technique of determining the sequences is carried out by

1- Cutting the strands at predetermined points by the use of restriction enzymes.

2- The fragments produced are then identified by either mono or multi- locus probes, which are short chains of DNA, linked to a radioactive isotope.

3- Using autoradiography, the endproduct, derived from any nucleated cellular material, is a radiograph carrying a series of bars, rather like the bar code.

4- From the presence of different bars in given positions, comparison may be made with other samples or the individual.

Medico legal importance of DNA typing

1- Identification of murder in crimes.

2- Identification of disputed paternity (it is a definitive paternity test).

3- Identification of body remains.

4- Identification of sex on species, which achieved by examining of polymorphism in the non-coding areas within the X or Y-chromosomes.

Advantages and disadvantages

- Specific DNA for each person.
- Same DNA sequel for one person.
- Stability of DNA.

2- Skeletal identification

A description of animal parts in details, these part to what species does it belong and do they belong to one or more animals. This could be known from the anatomical features in case of complete bones as the skull, scapula, sternum etc. or from precipitin test, in case of small pieces of bones, no clear anatomical features or in case of doubt.

3- Examination of bones

A medico-legal report on collection of bones should include the following data, any injuries to the bone structure or other abnormalities, the skull examination for the presence of any fractures especially the

region of the base, which may be easily overlooked, injuries to the vertebrae, the presence of callus which will indicate that fracture has occurred at a period before death long enough for its formation, are they animal or human bones and do they belong to one or more animal

Osteo-precipitin test

It is a confirmatory test applied in medico legal practice for the identification of the source of bone fragments. It is of value as corroborative evidence in certain difficult cases when the amount of available bone is scanty and identification by shape, measurement or contour is not possible. The technique for the preparation of osteoprecipitins using anti-human and different animal sera is the same as employed in the preparation of sera for precipitins for blood.

Procedure

- Obtaining a clear saline extract of the protein material derived from identified bones.
- Bone denuded of all tissues, osseous materials must be ground to powder and the bone extract is affected by soaking them in a solution of normal saline.
- Filtering the resultant solution by means of Backfield filter (in order to obtain a suitably clear solution for animal injection).
- Intravenous injection of rabbit with clear saline extract of the protein material derived from the identified bone so the rabbit

will form anti-protein. Prolonged immunization of rabbits with extracts of viscera has produced anti-sera capable of

differentiation between the liver and kidneys of the same animals.

- Serum containing antiprotein of identified bone is added to saline extract of protein materials of different animals.
- When precipitation occurs it is (+ ve) result.

4- Examination of hair

It is very important to identify the hair of each animal, as it is very important evidence in many crimes. It may be found on the body of the victim and prove to be belonging to the accused so it is considered good evidence against him.

Medico-legal importance

- It differentiates between animal and human hair.
- DNA examination of hair may be helpful to prove personal identity, as the DNA pattern is absolutely individual for every person.
- Diagnosis of cases of toxicity as in chronic arsenic toxicity where the metal is deposited in the hair of the victim, starting from the root and spreading to the tip so long as exposure or administration is continuous.
- It gives an idea about the distance of firing in firearm wounds.
- It differentiates between burn, scald and corrosion.
- Examination of the hair roots may give an idea about the manner of getting out this hair (fallen-pulled by force).
- Examination of the hair tip gives an idea about the date of its cutting.

Samples

Samples

Samples

Samples

Samples

Samples

Samples

Samples

4 Examination of Hair and Fibers

Hairs, which are composed primarily of the protein keratin, can be defined as slender outgrowths of the skin of mammals. Each species of animal possesses hair with characteristic length, color, shape, root appearance, and internal microscopic features that distinguish one animal from another. Considerable variability also exists in the types of hairs that are found on the body of an animal. In humans, hairs found on the head, pubic region, arms, legs, and other body areas have characteristics that can determine their origin. On animals, hair types include coarse outer hairs or guard hairs, the finer fur hairs, tactile hairs such as whiskers, and other hairs that originate from the tail and mane of an animal.

Because hairs can be transferred during physical contact, their presence can associate a suspect to a victim or a suspect/victim to a crime scene. The types of hair recovered and the condition and number of hairs found all impact on their value as evidence in a criminal investigation. Comparison of the microscopic characteristics of questioned hairs to known hair samples helps determine whether a transfer may have occurred

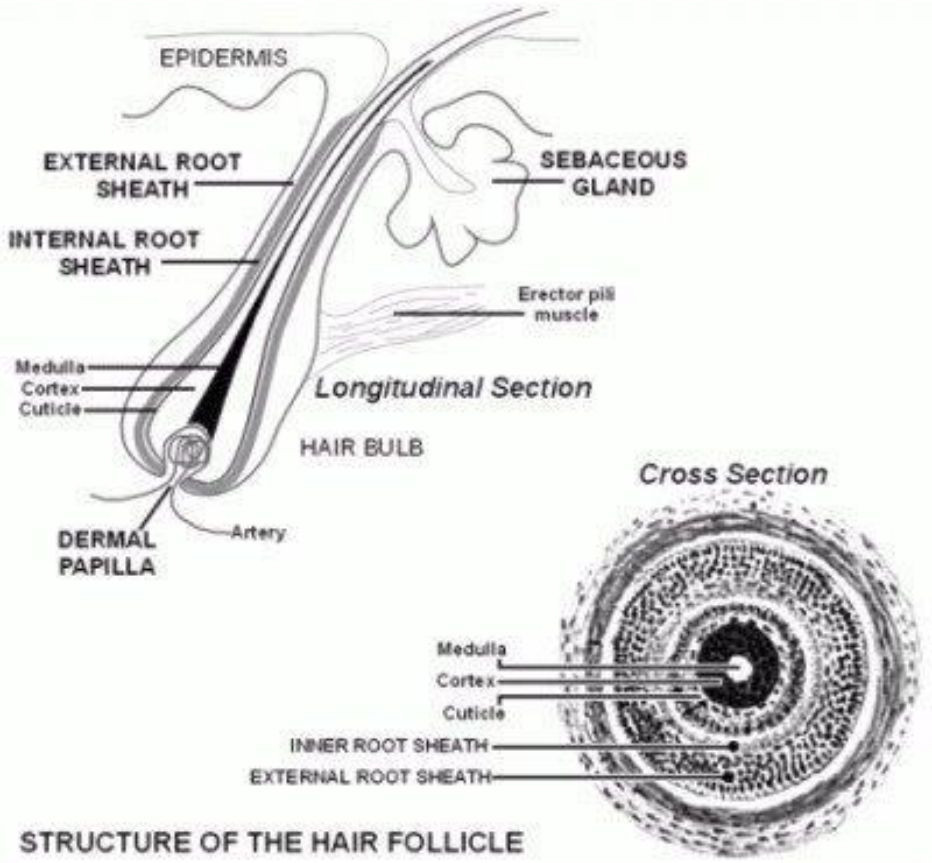
Types of cases which fiber and hair may be of value as evidence

- Assault and homicide, these types of crimes usually involve personal contact of some sort. Therefore, clothing fibers and hair may be interchanged between victim and suspect; that is, fibers/hairs from victim's clothing may be found on suspect's clothing and vice versa. Weapons and fingernail scrapings may also be important sources of fiber evidence. Bindings, such as rope, may also leave distinct fibers if a person was tied up.

- **Rape,** the nature of this crime can result in the cross transfer of fibers and hairs between clothing of victim and suspect and such articles as blankets or automobile seat covers. If a victim goes to the hospital for an exam, the hair combings may be good sources of hair and fiber evidence. Weapons and fingernail scrapings may also be sources of fiber evidence.
- **Burglary**, clothing fibers will frequently be found at the point where the burglar crawled through a window or other opening or climbed over a fence. If no head covering was used, hairs may also be found.
-**Hit-and-Run,** due to the forceful contact between victim and automobile, clothing fibers and hair can generally be found adhering to the fenders, grill, door handles, or parts of the undercarriage. Fabric impression patterns may also be observed on surfaces with which the fabric came into contact.

Medico legal importance

- Differentiation between human hair & animal hair and identification of the animal. Help in examination of meat in case of meat adulteration
- Differentiation between different types of wounds and the used instrument.
- Give information in sexual crimes as rape in human & bestiality in animals.
- Diagnosis of some cases of poisoning as Arsenic.



Collection, preservation and marking of fiber

EVIDENCE Before attempting specific procedures listed below, note the following general precautions:

1. The size of the container should correspond to the size of the object.

2. Do not package wet evidence. Fibers or objects containing fiber evidence should be air dried before being placed in sealed containers. Biological stains degrade with time. This process is accelerated when items are wet and sealed in airtight containers.

3 Do not package items on a surface without first thoroughly cleaning that surface. Avoiding cross contamination between all evidence and standards is imperative!

4. All seams of the packaging must be sealed to prevent the loss of trace evidence.

5. Label all evidence containers with submitter's initials, ID/badge number, agency name, case number, item number, source, and date

Collection procedures

1- Where fibers are visible and firmly attached to an inanimate object to be transported to the lab: Leave fibers intact. (a) Diagram and note exact location and approximate number of fibers adhering to each object (photograph if possible). (b) Label object and package in a container so that fibers cannot become dislodged in transit. (c) Label packaging with appropriate information.

2- Where fibers are visible and not firmly attached, or if firmly attached and object is too large to send to the lab: (a) After diagramming and noting each location and the number of fibers present, carefully remove with clean tweezers and package. (b) Place fibers in a small pill box, glass vial or other tightly sealed container. Fibers may also be placed in small folded paper bindles. (c) Label packaging with appropriate information.

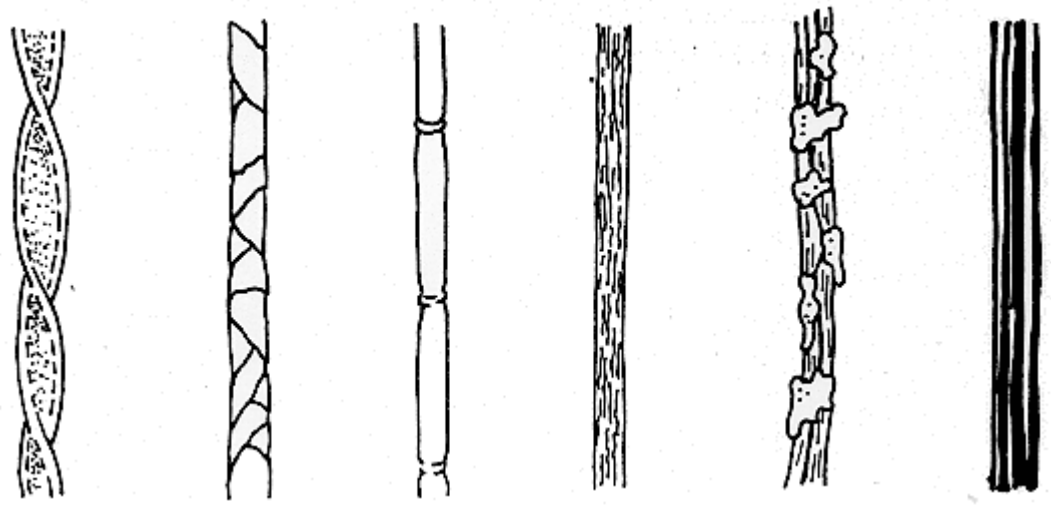
3- Where fibers are possibly transferred to clothing of victim or suspect: (a) Be sure clothing is dry before packaging. (b) Keep each item separate. (c) Avoid disturbing soil, dust, blood, seminal stains, or other foreign materials adhering to clothing. (d) If any of the aforementioned are apparent, see appropriate Evidence Submission Guideline for special instructions. (e) Place ID mark on each item in an easily located area that does not damage the clothing. (f) After allowing wet apparel to air dry, carefully fold and wrap each article separately, package, and label with appropriate information (layers of clean wrapping paper and new paper bags are suitable for this purpose).

4. For fingernail scrapings/clippings: (a) Take scrapings/clippings from both suspect and victim. (b) Use either a clean knife, clippers, or other instrument such as a fingernail file or toothpick. (c) Use a separate folded paper bindle for each hand to collect scrapings/clippings. (d) Place the folded and labeled bindles (i.e. “left hand”, “right hand”) in a pill box, glass vial or other small tightly sealed container and label with appropriate information.
5. Where fibers are in hair of suspect or victim: Comb the individual’s hair over clean white paper using a clean fine-tooth comb. Carefully fold the paper together with the comb and combings inside a bindle to prevent loss of any trace evidence. Place the bindle in an envelope and label with appropriate information.

Collection of fiber and hair standards for comparison

Fiber standards:

It will not always be known to the investigating officer whether there are fibers present in the submitted evidence. For this reason, care must be exercised when handling any item that could shed fibers and thereby cause cross contamination between items from suspects and victims. When fibers have been collected by the investigating team, it is imperative that appropriate and adequate standard samples also be submitted. For example, if fibers are found on the soles of the robbery suspect’s shoes, standard samples of the carpet or carpets at the crime scene should also be submitted. The standard samples should be a representative sampling and include variations due to color, style, type, fading, or staining. Standard samples with a minimum size of a quarter should be submitted.



Cotton	Wool	Linen	Nylon	Silk	Rayon

Hair sample standards

Whenever hair is collected the roots should be included because considerable information can be obtained from the root material.

What is the difference between hair & fibers?

1- By naked eye: Hair is stronger than fiber but this test not accurate.

2- Physical test: Burning a part of the sample.

Fibers	Hairs
Burn readily	Burn with difficulty
No disagreeable odor	Odor of burned feather
A shiny burn end	Curved end

3- Chemical test:

1ml water + 1ml concentrated sulfuric acid and shaking until dissolving of sample then add two drops of alcoholic solution of alpha-naphthol. Fibers give deep violet color while no change in color in case of hair.

4- Microscopic examination

It's the most important test, it require preparation of the sample as the following:

- Wash the sample in a mixture of equal parts of alcohol & ether for 10 minutes with shaking.
- Add xylol as a clearing agent for 10 minutes with shaking.
- Dry by filter papers.
- Put on a clean dry slide & fixed with Canada – balsam then covering with a clean cover slide.
- Examine under low power microscope then high power microscope.

Fibers:

1- Silk: appear as straight long shiny threads with well-defined boundary.

2- Linen fiber: straight segmented with cross striations and jointed marking

(Bamboo shaped).

3- Cotton fiber: flattened, twisted, tape like bands assuming more or less spiral form (twisted – ribbon).

4-Wool fibers: straight, with irregular serrated edge.

Hair identification

Histologicaly hair is formed of three layers:

1- Cuticle (outer layer): is a layer of delicate scales covering the cortex; it contains no pigments & no structures.

2- Cortex (middle layer): pigmented fibrous materials formed of long fibrillated cells, transverse striations present only in animal's hair.

3- Medulla (inner layer): present in the center of hair, present in many hair but not all, the thickness of medulla varies between different animal species, between animal & human and between different parts of the body in the same animal or human. The hair pigment is present in both cortex & medulla.

Human hair	Animal hair
Cuticle formed of one cell layer and it is regular in its margin.	Cuticle has more than one cell layer & has serrated margins
Cortex is broad and form the whole thickness of the hair, has only longitudinal striations and contain pigments or air bubbles (absent in white hair).	Cortex is thin and have longitudinal and transverse striations
Medulla is very narrow (may be absent), irregular and may be continuous in beard, pubic and moustache.	Medulla is thick, continuous, occupies ½ -3/4 of hair thickness, it differ from animal to animal and from part to part in the same animal.

Examination of hair

A- By naked eye:

Examination of the color, length, breadth & the nature of the debris adherent to the hair as fecal matter, semen, vaginal secretion, nasal discharge or blood, which indicate the part from which the hair is removed.

B- Microscopically

I – Examination the apex (tip) of the hair: -

- Tapering tips → cut since long time (more than 2 weeks).
- Sharply cut tip → recently cut by sharp instrument.
- Rounded tip → cut since 1-2 weeks.
- Crushed tip→ crushed by blunt instrument (ragged or brush like tip).
- Tip cut by scissors.

- Sharply cut hair or cut by scissors, 1 week curved tip, 2 weeks rounded tip 1 week tapering tip.

II – Examination of the base (root) of the hair :

- Forcibly pulled out hair, which has a normal root with ruptured sheath.
- Naturally fallen hair which has an atrophied root with absence of sheath.

Hair of different animals

Rat hair:

1- Irregular margin.

2- Medulla is very broad, occupy most of the hair about 2/3 of the total thickness, it's formed of 1-2 rows of rounded cells.

Rabbit's hair:

1- Medulla is formed of several adjacent small cells in different shape.

2- Medulla is broad & may occupy most of the hair thickness with slight serration at the margin.

Dog's hair:

1- Cuticle is thin & irregular.

2- Cortex is thin & serrated with longitudinal & transverse striations.

3- Medulla occupies about 1/3 of total hair thickness and containing cells in the form of spiral discs.

Camel's hair:

Camel has two types of hair, thin hair which are devoid of medulla & contains transverse striations and thick hair which composed of cuticle is serrated & irregular; Cortex contains brown lines & colored spots and medulla is broad & formed of one layer containing colored spots.

Horse hair:

Cortex is very thin & transverse striations not distinctly observed. Medulla is very thick occupied about ¾ of total thickness.

Cattle hair:

Coat hair is differ than tail hair . Coat hair is medulla may be absent, fragmented or continues occupy about ½ of total thickness, cortex contains transverse & longitudinal striations. Tail hair is thicker than coat hair, medulla rarely present and if present there's a thick piece of colored substances.

Goat's hair:

Medulla is thick & occupies about 2/3 of total thickness & it is unequal in thickness.

Buffalo's hair:

It differs along the same hair from black to yellow and from thick to thin. Cuticle is thin & irregular. Cortex has longitudinal & transverse striations. Medulla occupies 1/3-1/2 of total thickness. Medulla absents in tail hair. Cross section in coat hair is rounded or oval, with well-defined layers & irregular margin. Cross section in tail hair is pear shape, no medulla & irregular margin.

Possible results from laboratory examination of fiber and hair evidence

1. Fibers

a. Fiber classification (i.e. animal, vegetable, mineral, or synthetic) and sub-classification (e.g. polyester, nylon, acrylic).

b. Determination as to whether questioned fibers are the same type and similar color as the standard. Determination as to whether questioned and standard fibers share similar microscopic characteristics. (Note: Color and

microscopic characteristics of fibers may vary within a garment, carpet, drape, rope, etc. due to many factors such as wear or fading.)

c. Whether the fibers are common or uncommon.

d. An opinion as to whether questioned fibers could have originated from the same source as the standard.

2. Hairs

a. Of animal or human origin

b. If human:

1. Possible race of the person from which it originated.

2. Body area where the hair originated (i.e. head, pubic, body).

3. Possibly how the hair was removed from the body (e.g. naturally, forcibly removed).

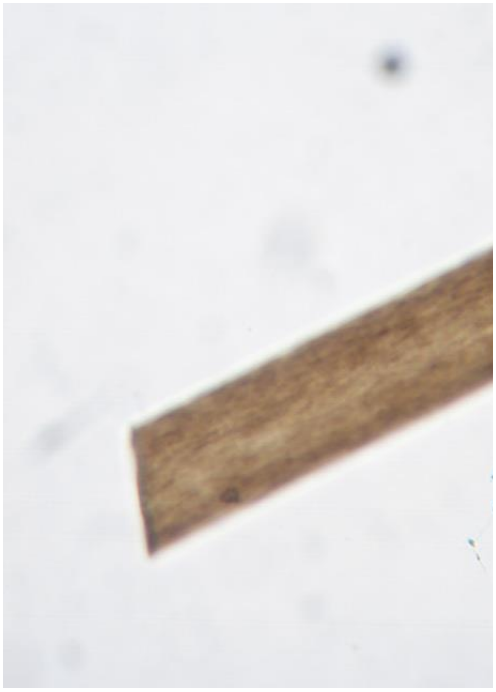
4. Whether hair has been altered by having been cut, bleached or dyed.

5. Whether a questioned hair could share common origin with a particular hair standard. When two hair samples have no significant macroscopic or microscopic differences. The ideal situation is to find one or more hairs in the known sample that correspond in all respects (no significant differences) with the questioned hair.

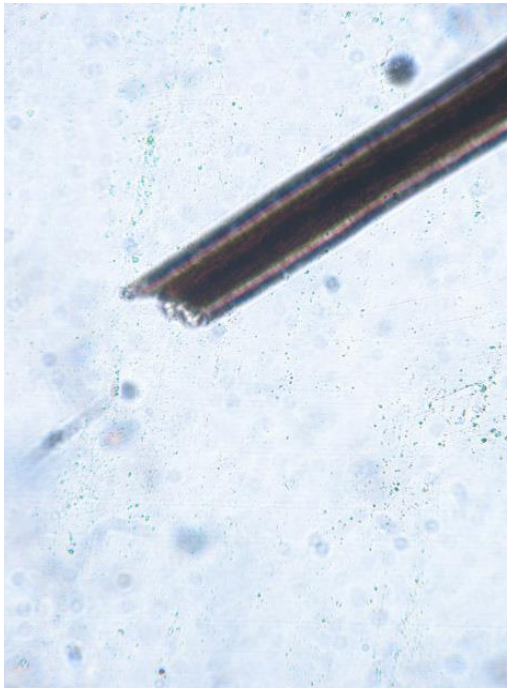
6. Whether a questioned hair could not share common origin with a particular hair standard. When significant differences exist in the macroscopic and/or microscopic characteristics exhibited by the questioned and known hairs, the questioned hairs cannot be associated with the source of the known hairs.

7. The results of a microscopical hair comparison can be inconclusive. Situations when an inconclusive result may be reached include, but are not

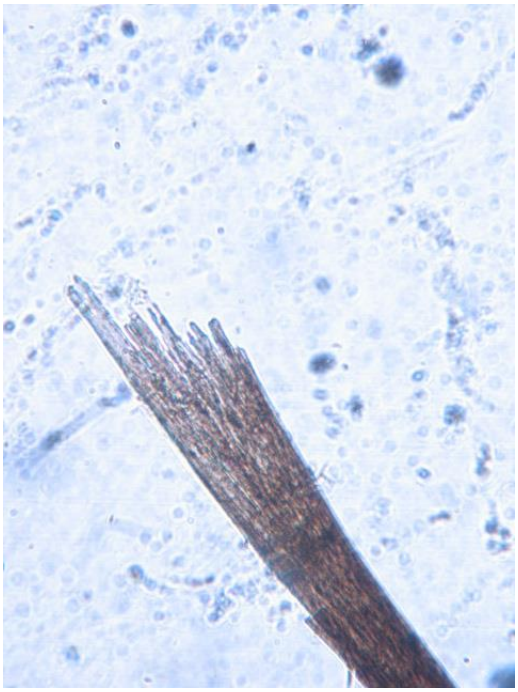
limited to, the following: an inadequate known hair sample, questioned and known hair samples that exhibit similarities and unexplained dissimilarities and hairs that do not exhibit sufficient distinguishing microscopical characteristics (e.g., broken, fragmented, too short, colorless, opaque)



Sharply cut hair tip



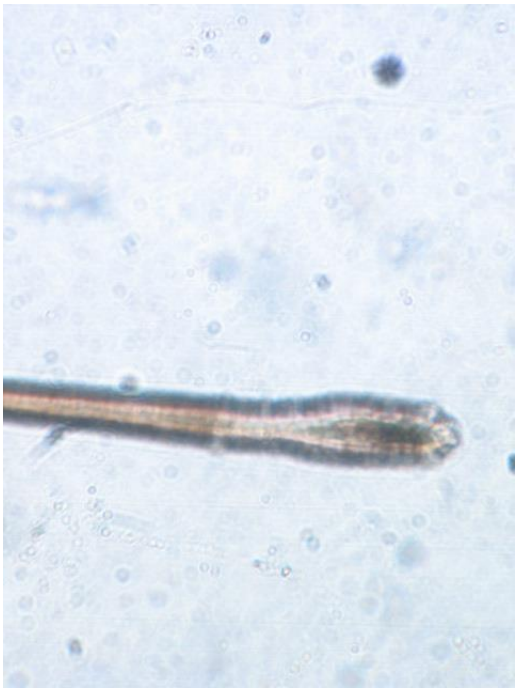
hair cut by scissor



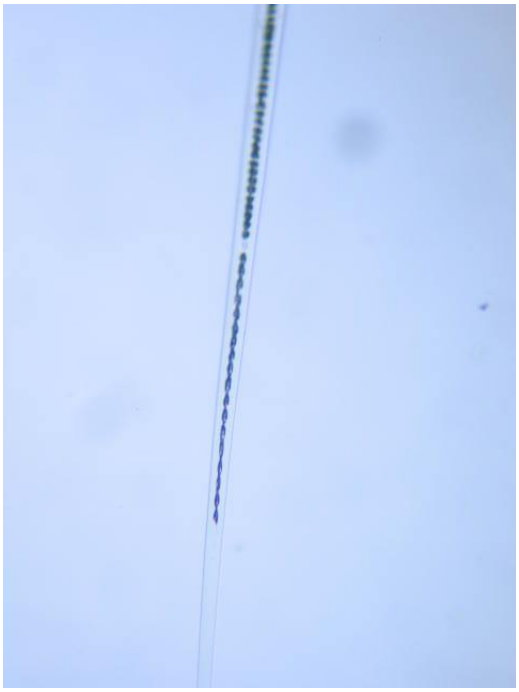
Crushed hair tip

Curved hair tip

Forcibly pulled out hair



Natural fallen hair



Rat hair

Rabbit hair

Samples

Samples

Samples

Samples

Samples

5 Animal Age Determination

Dentition pertains to the development of teeth and their arrangement in the mouth. In particular, it is the characteristic arrangement, kind, and number of teeth in a given species at a given age. That is, the number, type, and morpho-physiology (the physical shape) of the teeth of an animal. Animals whose teeth are all of the same type, such as most non-mammalian vertebrates, are said to have *homodont* dentition, whereas those whose teeth differ morphologically are said to have *heterodont* dentition. The dentition of animals with two successions of teeth (deciduous, permanent) is referred to as *diphyodont*, while the dentition of animals with only one set of teeth throughout life is *monophyodont*. The dentition of animals in which the teeth are continuously discarded and replaced throughout life is termed *polyphyodont*.

Medico legal importance of dentition:

1- Identify the age of the animal.
2- Identify the sex of the animal.
3- Identify the species of the animal.
4- Detection of some cases of toxicity.

Types of teeth according to the position & shape:

- **Incisors**: present in the anterior part of the jaw , they are (centrals , medials laterals & corners) , they usually appear milky teeth then changed to permanent one.

- **Canines**: which lies between incisors & premolar teeth, they may be appearing milky then converted permanent teeth in some species or appear permanent only in others.
- **Premolar teeth**: lies between canines &molar teeth, they appear milky then converted to permanent.
- **Molar teeth** : appear permanent only.

Structure of the teeth:

A- Externally:

- **Crown**: part, which appears from the gum, It's calcified white material.
- **Neck**: It's a part between crown & root which connecting the tooth with the gum.
- **Root**: part, which presents inside the gum. It has a cavity containing blood vessels & nerve supply to the tooth.

B- Internally :

- **Pulp**: It's a groove containing blood vissels & nerve supply.
- **Dentine**: solid substance, ivory color covering the pulp.
- **Enamel**: It's the most solid tissue in the body, covering the dentine at crown part & It's white in color.
- **Cement**: The most outward layer which covering all the previous structures.

Dentition in Horse

Differentiation between milky (temporary) & permanent teeth

Item	Milky teeth	Permanent tee
Neck	Clear	no neck
Root	Thin & small	Longer & strong
Size	Small	Larger
Color	More white	Ivory color
Shape	More rounded	More longer

Dental formula:

Upper jaw	Incisor	Canine	Premolar	molar
Lower jaw	Incisor	Canine	Premolar	molar

A-Temporary dental formula:

(3) Pairs of incisors in upper & lower jaw.

(3) Pairs of premolar in upper & lower jaw.

$$\frac{3\ 0\ 3\ 0}{3\ 0\ 3\ 0} = 12 \times 2 = 24$$ in both male & female.

Temporary dental formula is completed at one year.

B- Permanent dental formula :

Three pairs of incisors in upper & lower jaw.

One pairs of canines in male only.

Three Pairs of premolar teeth in upper & lower jaw.

Three Pairs of molar teeth in upper & lower jaw.

- In male $\frac{3\ 1\ 3\ 3}{3\ 1\ 3\ 3} = 20 \times 2 = 40$

- In female $\frac{3\ 0\ 3\ 3}{3\ 0\ 3\ 3} = 18 \times 2 = 36$

The permanent dental formula is completed at five years old.

Characteristic points of horse's teeth:

1- Table : Shape of table (surface of the incisors) changed from elliptical, oval, quadrilateral & triangular according to advancing of the age as the following:

Incisors	Elliptical	Oval	Quadrilater	Triangular
Central	5-6 Year	6-7	7-8	8-9
Intermediate	6-7	7-8	8-9	9-10
Corners	7-8	8-9	9-10	More than 10

2- **Infundibulum or Mark,** is a dark depression on the table, pyramidal shape with its base toward the surface, it's surrounded with two layers of enamel (internal & external layer) it take the shape of table till becomes shallower, rounded, small point then disappear at 13th years from central, 14th years from intermediate (lateral) and in 15th years from corner. The color of this mark is black due to filling with food & fermentation.

3- Dental star: appeared due to continuous corrosion & wearing of teeth, it's present on the table containing the pulp, which is covered by dentine to protect the sensitive structures. It's present anterior to the infundibulum as a line of ivory color, it appear at 8th years on central , 9th years on intermediate and 10th years on corners

Mark	**Dental star**
Dark color	Ivory color
Surrounded by two layers	One layer of enamel
Present in young age till 13 years	Appear at 8 years
Elliptical to rounded shape	longitudinal line

4- Time of eruption of milky & permanent teeth in horse

Teeth	**Milky**	**Permanent**
Central	birth – 2 week	2 – 3 years
Intermediate	2 – 4 week	3 – 4 years
Corners	7 – 9 month	4 – 5 years

Canine in Males		4 – 5 years
Premolar 1		2-3 years
2	2-4 weeks	2-3 years
3		3-4 years
Molars 1		9-12 month
2		1.6-2 years
3		3-4 years

5- Shell likes appearance: Which observed on the upper corner at one year, when temporary teeth are completed) or at 5^{th} years, (when permanent teeth is completed).

6- Appearance of hock: It present on upper corner at two ages only (7^{th} & 13^{th} years) then disappear.

7- Galvayne's groove:

It's a groove appear on the upper corner at 10^{th} years old. It reaches to the middle of the corner at 15^{th} years. It appears on all the crown of corners at 20^{th} years. It begins to disappear at 21 years old. It disappears from the proximal half of the corners at 25 years old. It disappears from all the crown of the corners at 30^{th} years.

Decrease the age of the animal as away of adulteration:

That done by removing the dental star & make another mark on the surface of the teeth through making a deep groove by using a very hot iron nail to make it's shape similar to the Infundibulum but we can detect that by:

- Presence of dark color on surface of teeth due to firing.
- Absence of enamel which surround the infundibulum.
- Presence of Galvyne's groove.
- The angle between two jaws more sharp.

- The shape of the surface of the teeth is triangular.

Dentition in cattle

Teeth of cattle classified in to incisors (central, medial, lateral & corners), premolar & molars teeth. The crown of the incisors is spatula shape where there's no replacement of worn part from the root, so the teeth become shorter with advanced ages.There are no incisors in the upper jaw where they are replaced by a dense fibrous tissue covered with tough mucosa (dental pad).

Dental formula:

I- Temporary dental formula (T.D.F) is completed at 6 months.

$$\frac{0\ 0\ 3\ 0}{4\ 0\ 3\ 0} = 10 \times 2 = 20$$ in both male & female

II- Permanent dental formula (P.D.F) is completed at 4.6 years.

$$\frac{0\ 0\ 3\ 3}{4\ 0\ 3\ 3} = 16 \times 2 = 32$$ in both male & female

Time of eruption of teeth in horse

Teeth	Milky	Permanent
Centrals	Birth-2 weeks	1.9 – 2 years
Medials	Birth-2 weeks	2.6 – 3 years
Laterals	2-4 weeks	3.6 – 4 years
Corners	2-4 weeks	4.3 – 4.6 years
Premolars 1		1.9-2 years
Premolars 2	2-4 weeks	1.9-2 years
Premolars 3		2.9 years
Molars 1		6 months
Molars 2		1.3 years
Molars 3		1.9-2 years

Due to continuous wearing of teeth there's a space between incisors which help in determi
the age of the animal as the following:

6 years	space between central
7 years	between central & medial
8 years	between medial & lateral
9 years	between lateral & corners

10 years	- appearance of cup shape where most, of the crown is worn an only a small part of enamel is present as a cup
12 –14 years	maize-shape where the teeth are widely separated from each othe first then close together at16years.

Dentition in sheep

I- Temporary dental formula is completed at one month.

$$\frac{0\ 0\ 3\ 0}{4\ 0\ 3\ 0} = 10 \times 2 = 20$$ in both male & female

II- Permanent dental formula is completed at 3 years

$$\frac{0\ 0\ 3\ 3}{4\ 0\ 3\ 3} = 16 \times 2 = 32$$ in both male & female

Time of eruption of teeth in sheep

Teeth	Milky	Permanent
Central	Birth – 2 weeks	1.3 years
Medial	Birth – 2 weeks	1.9 years
Lateral	2 – 4 weeks	2.3 years
Corners	2 – 4 weeks	2.9 years
Premolar 1		1.9 years
2	4 weeks	1.9 years

	3		2 years
Molars	**1**		3 months
	2		9 months
	3		1.6 months

- Cup shape appears at 5 years.
- Falling of teeth at 10-12 years.

Dentition in camel

Camel's teeth characterized by its funnel shape, it has no surface except after wearing & no infundibulum or dental star. The upper jaw containing only one pair of corners while other incisors replaced by dental bad. Canines appear milky then converted to permanent. The lower jaw has two premolar teeth only. - Corners & 1st premolar (permanent) take the shape of canines. Presence of space between incisors & canines which increase with age. After 8 years age is determined by, degree of wearing, shape of teeth size, thickness & color of canines and incisors have table as horse at 12-14 years.

Dental formula

I- Temporary (milky) dental formula in both male & female is completed at 6 months.

$$\frac{1\ 1\ 3\ 0}{3\ 1\ 2\ 0} = 11 \times 2 = 22$$

II- permanent dental formula

1 1 3 3

---------- = 17 x 2 = 34 in both male & female is completed at 7.6 years

1 1 2 3

Time of teeth eruption:

Upper jaw:

Teeth	Milky	Permanent
Corners	2 – 4 months	6 – 7 years
Canines	2 – 4 months	6 – 7 years
Premolars 1		6.6 – 7.6 years
2	Birth – 4 weeks	5 – 5.6 years
3		5 – 5.6 years
Molars 1		1 – 1.3 years
2		5 – 5.6 years
3		

Lower jaw:

Teeth	Milky	Permanent
Central	Birth – 2 weeks	4.6 – 5 years
Intermediate	2 – 4 weeks	5.6 – 6 years
Corners	6 – 8 weeks	6.6 – 7 years
Canines	2 – 4 months	6 – 7 years
Premolar 1		6.6 – 7.6 years
2	birth – 4 weeks	5 – 5.6 years

Molars	**1**		1-1.3 years
	2		2.6-3 years
	3		5-5.6 years

Dentition in dogs

Dental formula

I – Temporary dental formula is completed at 3 – 6 weeks

$$\frac{3\ 1\ 3\ 0}{3\ 1\ 3\ 0} = 14 \times 2 = 28$$ in both male & female

II – Permanent dental formula is completed within one year:

$$\frac{3\ 1\ 4\ 2}{3\ 1\ 4\ 3} = 21 \times 2 = 42$$ in both male & female

Teeth eruption time

Teeth	Milky	Permanent
Central		4 months
Intermediate	4-5 weeks	4 months
Corners		5-7 months
Canines	3-4 weeks	5-7 months
Premolar 1		4 months
Premolar 2	4-5 weeks	5-7 months
Premolar 3		5-7 months
Premolar 4	Not erupted	5-7 months

Molars 1		4 months
Molars 2		5-6 months
Molars 3 (Lower jaw)		6-9 months

- Incisors characterized by presence of Lotus shape, which composed of three cups on the crown (large central cup & two small lateral cups).

- Disappearing of Lotus shape from incisors help in determination the age where continues wearing of middle cup till become equal to lateral cups leading to disappear of Lotus shape.

- 2 years --------- Lotus shapes disappear from centrals of lower jaw.
- 3 years ---------disappear from intermediate (lateral) of lower jaw.

- 4 years --------- disappear from centrals of upper jaw.
- 5 years --------- disappear from intermediate of upper jaw.
- After 5 years --- all incisors take the same level.
- By increasing age wearing increase and incisors appear as roots.

Samples

Samples

Samples

Samples

Samples

Samples

Samples

Samples

Samples

6 Blood Stain Examination

It is one of the most important medico legal evidence, which may be found at the scene of the crime. The articles must be examined in a good light for stains of suspicious nature using a hand lens to assist the search. The precise situation and size of any stain must be recorded before its removal. Blood spurting from an artery tends to spray resembling of flea marks or pea shaped, and welling up from veins to run down over the body on the under surface. Color of the blood varies depending on a number of factors like age of stain, amount of blood, origin of blood (arterial - venous) and the nature and the color of the articles. Bloodstains are at first red gradually changing to brown as the hemoglobin changes to met-hemoglobin and haematin. The rates at which this changes occur depend on: a) the thickness of the stain b) on the conditions to which it has been exposed as stains on leather change almost at once, on hard surface such as glass the change is very slow and they remain reddish for months, while on dark fabrics or dark surface no red color can be seen at any time.

Bloodstain Pattern Analysis

Often found at the scenes of violent crimes, the analysis of bloodstains can provide vital clues as to the occurrence of events. Though bloodstain pattern analysis (BPA) can be a subjective area of study at times and often reliant on the experience of the investigator, the idea that blood will obey certain laws of physics enables the examination of blood at an incident scene and on items of evidence to offer at least an insight into

what was likely to have occurred. The successful interpretation of bloodstain patterns may provide clues as to the nature of the offence, the possible sequence of events, any disturbance to the scene that may have occurred, and even the position of individuals and objects during the incident. It may prove beneficial in refuting or corroborating eyewitness accounts.

Types

The appearance of a bloodstain can depend on a number of factors, including the velocity at which it was travelling, distance travelled, the amount of blood, the angle of impact, and the type of target onto which it lands.

Single Drop

These bloodstains typically refer to blood drops that have fallen vertically, whether it be from an injured person or another object, and landed onto another surface. As a blood drop falls perpendicular to a surface it maintains a spherical form until impacting. The size and appearance of this stain will depend on a number of factors. The volume of a single drop of blood will vary depending on the quantity of blood present and the surface area available from which the drop is falling. As would be expected, a larger surface area would allow for larger drop of blood to form before falling. The height from which the blood falls will affect the size of the stain, with greater heights tending to result in larger bloodstains. Furthermore, the target surface itself will cause an effect, with absorbent surfaces usually producing smaller stains than non-absorbent targets. The nature of the target can alter the appearance of the

stain. For instance, a rough target surface can result in increased distortion to the stain and even satellite stains, which additional stains are radiating outwards. A drop of blood falling into an existing bloodstain will result in a drip pattern.

Impact Spatter

This type of bloodstain is the result of a forceful impact between an object and wet blood, causing the blood to break into smaller droplets. A greater force will typically produce smaller droplets, with the density of blood drops decreasing moving further away from the initial blood source. The study of impact spatter may provide insight into the relative position of individuals and objects during an incident and the nature of the incident.

Cast-Off Stain

Cast-off bloodstains occur when centrifugal force causes blood drops to fall from a bloodied object in motion. Similarly, cessation cast-off patterns may result from the sudden deceleration of an object. In this instance, the blood flung from a blood-stained object, such as a weapon, may produce characteristic patterns of numerous individual blood drops forming a curved or straight line. If an object is repeatedly moved, each subsequent swing will result in less cast-off as less blood remains on the object. Bloodstains produced in this fashion can be particularly difficult to interpret as there is a great deal of possible variation in patterns produced. However depending on the nature of the motion of the bloodied object, cast-off blood will at least produce relatively linear stains.

Transfer Bloodstains

Transfer or contact stains result when a bloodied surface comes into contact with another surface, transferring blood to that secondary target. The study of this type of bloodstain can prove particularly beneficial in establishing a sequence of events at the incident scene and tracing the movement of objects or individuals. In some cases it may even be possible to establish what object the transfer stain was likely to be caused by, for instance if a particular pattern is produced that can be traced to a blood-bearing object. Similarly, such bloodstains may be left by the hands of an individual, thus opening the possibility of fingerprint evidence.

Projected Pattern/Arterial Damage Stain

This type of bloodstain results from the discharge of pressurised blood onto a target surface, for instance the ejection of blood from a punctured artery. Areas of the body in which wounding may cause arterial bloodstains include the carotid artery, the radial artery in the wrist, the femoral artery in the inner thigh, the brachial artery in the arm, temporal regions of the head, and the aorta (though damage to the aorta is less likely due to increased protection of the chest cavity). Blood is expelled from the artery as the heart continues to pump and, as the blood travels, it breaks up into smaller individual droplets. Bloodstains produced will usually represent the beating of the heart as blood is expelled in periodic spurts. The resulting bloodstains can vary depending on a variety of factors, including whether the victim was stationary or moving as blood was being ejected, where on the body the injury occurred and the extent of the wound. If a wound is smaller in size, naturally smaller blood drops will be produced, which can subsequently be expelled further from the injury site than larger blood drops.

Pool Stains

Pooling bloodstains refer to the accumulation of blood on a particular surface, generally from prolonged bleeding from a wound or accumulation of arterial blood. If a body is not present at the incident scene, depending on the quantity of blood present, it may even be possible to roughly estimate whether the victim is likely to be dead or alive based on how much blood they have lost.

Insect Stains

These are bloodstains resulting from insect activity. The presence of insects such as flies at an incident scene, particularly one involving blood, is not uncommon. Flies may feed on blood and tissues at the scene and then, following regurgitation or excretion, produce small circular stains known as flyspeck. This minute stain could be mistaken for alternative bloodstains, such as expirated blood. Furthermore, small additional stains may be caused by insects walking through a stain, thus spreading the blood.

Expiration Stains

Often associated with injury to the respiratory tract, this type of bloodstain is caused by blood being coughed or otherwise expelled from the mouth. The stains will often be slightly diluted in appearance due to the additional presence of saliva or mucous. When blood is expirated from the mouth, it will often produce a pattern of small, round stains that could be likened to a fine mist.

Examination of Bloodstain Patterns

Various factors must be taken into account in order to successfully interpret a bloodstain. The surface onto which the blood is found may have had an effect on the behaviour and appearance of the stain. For instance, a bloodstain pattern may appear different if landing on an absorbent surface such as fabric as oppose to tile or plastic. Studying the state of the bloodstain may be able to shed light onto how much time has passed since the blood was shed, as over time blood will naturally coagulate (the process by which liquid blood turns into a gelatinous substance through various clotting factors). Furthermore, the extent of drying or coagulation will depend on the quantity of blood present – for instance a single drop will dry significantly faster than a large pool of blood. During this process of coagulation serum stains may be formed, which occur when the serum (liquid portion of the blood) separates.

Bloodstains at an incident scene may not always be visible to the naked eye, either due to low amounts of blood present or an individual cleaning in attempts to remove signs of bloodshed. Despite the use of cleaning reagents or even attempting to cover the stains with paint, detectable traces will generally remain, which can be visualised using various chemicals or specialised light. Although blood will not fluoresce under UV light like some bodily fluids, it will significantly darken, thus enhancing its visibility. Furthermore, certain chemical reagents can be used to visualise latent bloodstains. These tests, such as luminol and phenolphthalein, generally work by reacting with a constituent of blood to produce some kind of chemiluminescence. However it should always be remembered that these chemical reagent tests are often presumptive,

meaning that they can only indicate that the stain is possibly blood. In reality, other substances may react with the reagent in the same way.

A lack of a bloodstain can be just as revealing. The absence of blood in a continuous bloodstain is known as a void, and may suggest that something or someone was present in that area when the bloodstain was caused. This could indicate an object present at the time of the incident has been removed from the scene, or an individual (or even multiple individuals) were present in specific locations when blood was shed. It can easily be incorrectly assumed that blood found at an incident scene belongs to a victim, however it must be taken into account that some bloodstains may have resulted from the perpetrator being injured at some point. Either way, the information available from the presence of bloodstains is not limited to bloodstain pattern analysis, but also DNA analysis.

Point of Origin – Directionality and Angle of Impact

In the reconstruction of an incident scene involving bloodstains, it is often beneficial to establish the point of origin of bloodstains, based on directionality and angle of impact. The examination of certain bloodstains may allow for the direction of travel of blood as it impacted the target. Whereas a drop landing perpendicular to a surface (depending on the type of surface) will tend to produce a more circular pattern, those landing at an angle will result in an elongated stain. The tapered end of this stain will generally point in the direction in which the droplet was travelling. Small amounts of blood may break away from the parent stain entirely – these are known as satellite stains.

Although it may be possible to estimate area of origin this purely through visual observation of bloodstain patterns, in some instances trigonometry may be utilised to determine a more precise point of origin. Depending on the type of bloodstain pattern, it may be possible to establish the angle at which a blood droplet hit a target, referred to as the angle of impact. By measuring the ratio of the width of the bloodstain to the length, it can be possible to calculate the angle of impact. If the angle of impact of multiple bloodstains is established, it may be possible to determine the area of convergence (the point where lines of travel from multiple stains meet) through stringing techniques and establish the area of origin.

Documentation and Collection

Documentation of bloodstain evidence will most typically be carried out using photography, including photographs of the wider scene along with close-up images of particular bloodstains. A ruler or other form of scale may be placed in the photograph in order to give perspective as to the size of a bloodstain. Sketches and even videos may also be utilised for further documentation. Collection of bloodstain evidence can be a complex matter, as the evidence will not likely be confined to a small object that can be easily removed from the scene. After rigorous documentation of the evidence, ideally the bloodstains themselves will be collected. This can involve simply removing objects from the scene or, more problematically, sections of carpet or large pieces of furniture. Evidence removed should be packaged in such a way that the stains are not altered or damaged. Collection of blood evidence for the purpose of DNA profiling will generally be conducted using a swab.

Extraction of the stain:

It takes place by dissolving the stain in a suitable solution, fresh stains are dissolved in distilled water or saline, old stains are dissolved in dilute acids and alkalis while very old stains are dissolved in concentrated acids and alkalis. Other stain solvents are, Chloral hydrate 10%, Saturated solution of borax. , Glycerin 10%, 4- Diluted solution of ammonia, Vibert's solution (2g Na cl + 0.5 g mercuric chloride + 100 ml distilled water), HCL 2% to remove the stain from leather and wood (old stain) and HCL 5% to remove the stain exposed to heat (very old stain).

Is a stain blood?

Tests to prove that stain is blood are classified into:

I-Preliminary tests, include, protein test, foam test, ammonia test and the peroxidase tests (guaiacum test, benzidine test kastle meyer tests and Malachite green test).

II-Confirmatory tests, include, microscopical, microchemical, spectroscopic and biological tests.

I- Preliminary tests (macro chemical tests):

1- Gather's (foam) test:

It is used in case of rusty weapons suspected to have blood on them.

A little of the scraped material on a watch glass + 1-2 drops of distilled water previously made alkaline by addition of ammonia + few drop of hydrogen peroxide-→ bubbles of gas are evolved to the surface giving the fluid the appearance of foam.

2- Protein test:

Heat the portion of soaking to about 90 °C, the color is entirely destroyed and muddy brown flocculent precipitate is formed which can be re dissolved by the addition of dilute ammonia, giving rise to a di-chromic liquid (green in reflected light and red by transmitted light).

3- Ammonia test:

To differentiate between blood stains and other vegetable stains having red color as carrot and cochineal. Add a drop or two of weak solution of ammonia to small portion of the colored soaking. If the color remain unchanged, it is blood but if the color changed into yellow or green it is carrot but if it is crimson, it is cochin.

4- The peroxidase test

It depends on the presence of oxidase enzyme in the blood, which is present in other stains than blood as rust, iodide, milk, semen and saliva. They are good negative tests for blood if the reaction is negative and positive reactions don't indicate blood (they can exclude the presence of blood in absence of oxidase, but they can't prove).

a) Guaiacum test: sensitivity 1:5000

In a test tube put 0.5 ml of freshly prepared guaiacum reagent solution (saturated guaiacum resin in rectified alcohol) + equal volume of the stain solution (will observe dirty reddish brown precipitate) + 0.5 ml of the hydrogen peroxidase $\rightarrow$ beautiful blue (green) color (the stain is of blood origin).

b) Leucomalachite green test:

This test generally more specifics than benzidine test as not give positive result with plant juices and another substances with which benzidine may react. A drop of the reagent (1 g of Leucomalachite green + 100 ml of acetic acid + 150 ml of distilled water) is dropped beside a fragment of the stain on white filter paper. A green color appears only after the addition of peroxide (within 10 seconds) indicates bloodstain.

c) Benzidine test: sensitivity: 1:300,000

One drop of the reagent (two parts of 10% solution of benzidine in glacial fresh solution to 20 volume of hydrogen peroxide) + One drop of the test solution is $\rightarrow$ Immediate deep blue coloration indicates bloodstain but a positive result may be given with pus, body secretions and with plant juice.

d) The Phenolphthalein test (Kastle Meyer)

It is accurate to 10-15 million dilutions. Several drops of the stain in a watch glass + a drop or two of Kastle-Meyer reagent, is consists of (2g phenolphthalein + 20g potassium hydroxide + 100 ml distilled water) boiled till become clear then add 20 g powdered zinc during boiling. Then add 20 volume of zinc of hydrogen peroxidase. A pink color indicates a positive result.

II- Confirmatory tests:

I- **Micro chemical tests,** these are most useful tests depending on the presence of hemoglobin.

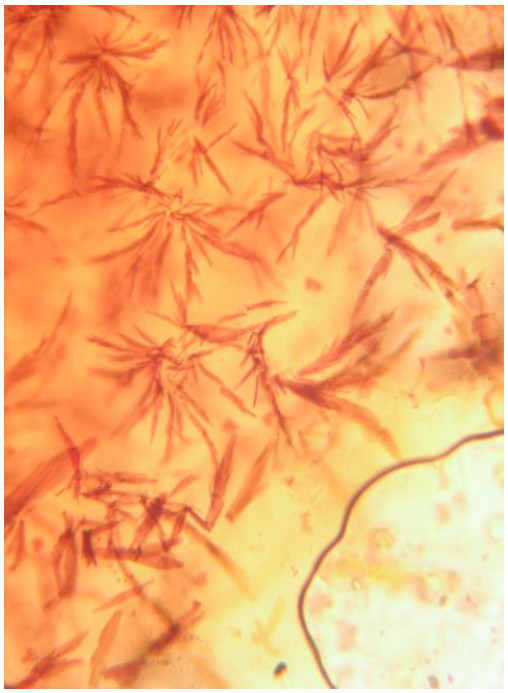
II-

I- Haemochromogen (Takayama) test

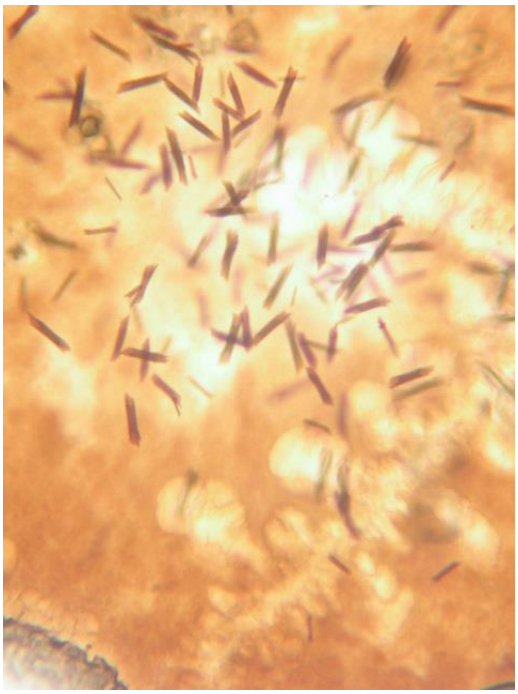
Takayama reagent: It consists of 3 ml sodium hydroxide 10% + 3 ml pyridine 10% solution + 3 ml saturated solution of glucose + 7 ml distilled water the reagent should be kept in an amber-colored bottle.

Procedure:

Add a drop of Takayama reagent to a small portion of the suspected material on a slide and covered with a cover slip. Warm the slide gently till drying but avoid boiling. Microscopically: haemochromogen crystals (irregular rhomboid needle shaped crystals arranged in clusters, rosettes and feather in shape) brown to pink in color). Micro spectroscope: the spectrum of haemochromogen appears (alkaline reduced haematin).



Haemochromogen crystals



Haemin crystals

5- Haemin (Teichman) test:

Teichmann reagent is composed of 0.1 g sodium chloride + 0.1 g sodium bromide + 0.1 g sodium iodide + 100 ml glacial acetic acid

Procedure:

A small dry fragment of clot or from the suspected material is put on glass slide then add one or two drops of Teichmann's reagent. A cover slip is placed on the slide. The slide is gently heated over a low flame. Cool the slide and examine using the microscope. Brownish-red small crystals of haemin (haematin hydrochloride) appear in-groups usually have a prismatic form, some with rhombic termination, spindle shape and other are jointed at an angle or cross each other or appears as (Chinese letters).The stain must be dry, the acid must be anhydrous and the slide must not be over heated.

II- Microscopical examination:

It depends on the presence of RBCs so it is useful fresh stain only.

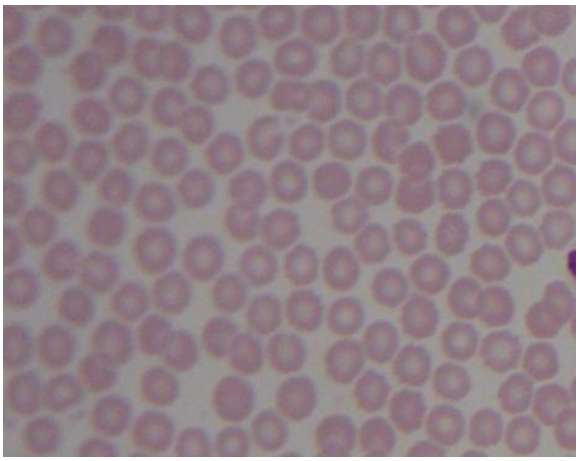
Microscopical examination depends on:

1- Species:

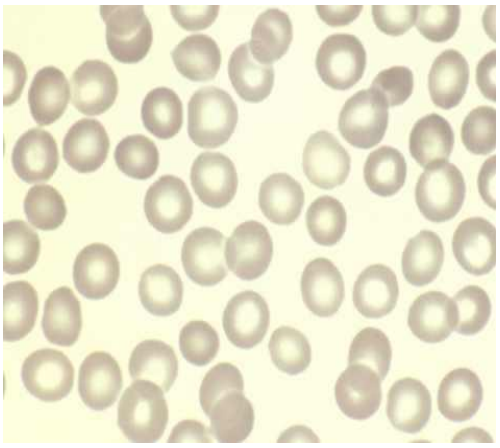
a) Mature red blood cells of domestic mammals are non-nucleated biconcave disk and the depth and size of concavity vary with species. The erythrocytes of dog, cow and sheep have fairly typical biconcave.

- The erythrocytes of horse and cat have a shallow concavity. Those of pig and goat have erythrocytes similar to flattened disk while they are oval. Camel, are oval non-nucleated.

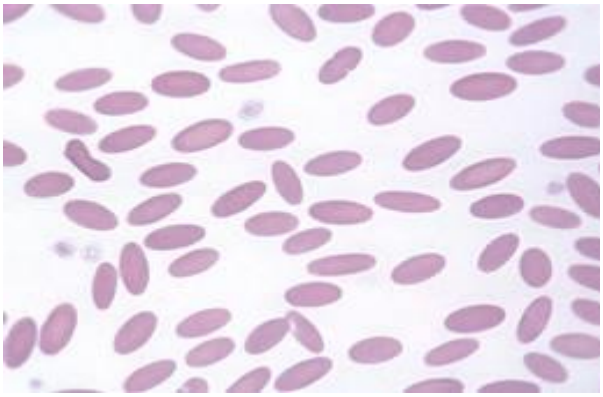
b) All birds, amphibians, reptiles and fishes have oval nucleated red cells, and except the lamprey they are circular.



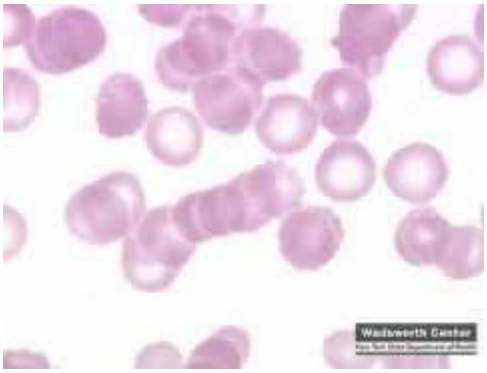
Canine erythrocyte



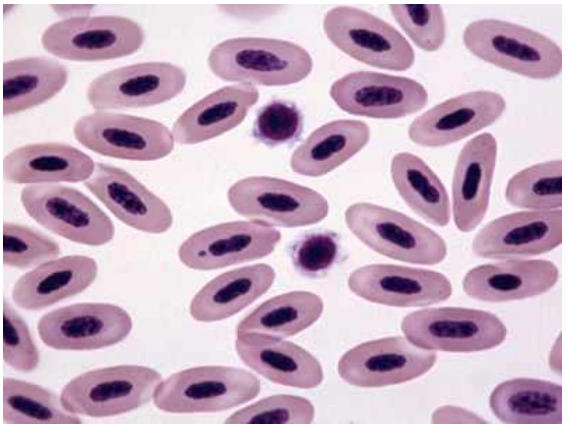
Cat erythrocyte



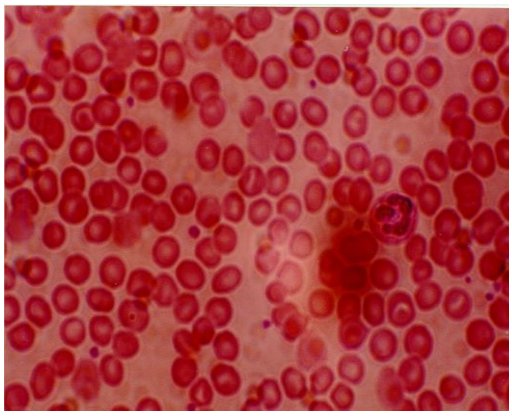
Camel erythrocyte



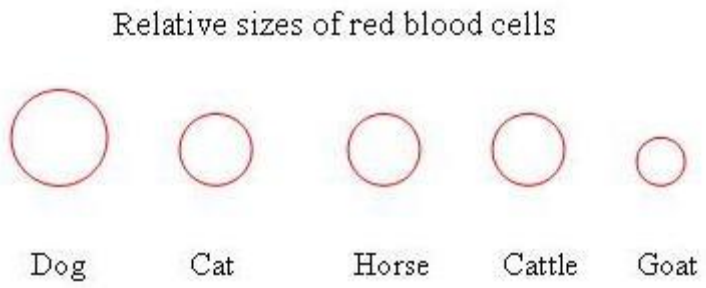
Horse erythrocyte (rouleaux formation)



Avian erythrocyte



Human erythrocyte



III- Spectroscopic test:

Blood pigment can absorb light of certain wavelengths. When examined by spectroscope certain dark absorption bands are observed in different parts of spectrum which are characteristic. Blood pigment is very stable and by the action of suitable reagents, different spectra may be obtained from the same sample of blood. No substance other than Hb can give these spectra in their order on addition of the corresponding chemical reagents.

Procedure:

1- Put the stain fluid in a small test tube if examination is to be made by the hand spectroscope or in a sorby cell if the microscope is to be used.
2- The spectroscope must be focused and slit adjusted until the frauenhofer lines are sharp and distinct.
3- The stain fluid interposed between the instrument and the source of light.

Result:

1- Oxyhaemoglobin (bright red): show two bands between D and E. The band close to D line, being darker and narrower, the second band is less sharply defined.
2- Reduced hemoglobin (violet) is formed due to addition of a reducing agent like ammonium sulfide, show one broad band of reduced Hb between D and E lines.
3- Carboxyhaemoglobin (crimson red): show two bands between D and E but is shifted to the right. It is unaffected by reducing agents, but otherwise behaves like oxyhaemoglobin.
4- Haemochromogen (violet) is formed due to the addition of alkali to reduced Hb. Show two bands in D-E interval, the first is dark very sharply defined in the midway between D and E while the second is broader but less distinct in the green on the left of E.
5- Methaemoglobin: show four bands, the two like oxyhaemoglobin position, one in the red between C and D- lines and the fourth is a faint band in the green. Methaemoglobin is darker pigment which forms when blood decomposes or as a result of poisoning by sulfa,
6-

nitrite, sewer gas and aniline. It will appear when oxyhaemoglobin is treated with potassium ferricyanide or dilute acids.

DNA:

Blood contains DNA, and depending on the size of the stain and its condition (old, new, dry, etc.), a forensic scientist may be able to get enough information to obtain a highly probable match of a suspect with the evidence. Two techniques are heavily used by forensic scientists in evaluating DNA evidence from blood or other body tissues – polymerase chain reaction (PCR) and variable number tandem repeats (VNTR's).

Type:

Blood typing can be used as an initial test to exclude some suspected sources of a bloodstain. For example, if a blood stain at the crime scene contains Type A blood, but the key suspect has Type O blood, the suspect could be excluded as a source of the blood stain – meaning he or she definitely did not leave the blood stain. However, blood type alone usually cannot positively identify a suspect because many people share the same blood type.

Samples

Samples

Samples

Samples

Samples

Samples

Samples

7 Examination of Seminal Fluid and Stain

Sexual offences

There are many sexual offences and the most important in the veterinary practice is the bestiality.

Bestiality: this is sexual intercourse between human beings male and animals. Seminal stain may be present on the clothes of the offender, on the pubic hairs or in the animal's vagina.

Examination of seminal stains is usually needed in cases of sexual offences. One may have to examine dry stain on garments or clothes or may asked to examine an animal for the presence of human seminal material in its vagina or vulva in crimes of bestiality.

Tests for semen

I- Inspection with the necked eye:

Seminal stain present a characteristic appearance on undyed linen or cotton articles and on woolen or other rough articles, similar to that produced by a dilute solution of albumen. It stiffens the fabric and gives it, if undyed a faint yellowish color and when fresh a characteristic odor. If the garment or cloth is examined under filtered ultraviolet rays, areas stained with seminal discharges show a faint bluish fluorescence (this fluorescence, however is not specific but it may enable the observer to detect suspicious areas).

II- Preliminary

1- Florence's test

It depends on presence of choline in semen that is also present in bile and serum so it is a good negative test i.e. can disprove that the stain is seminal but can't prove.

Procedure:

1- The stained cloth is soaked in acidified water (one drop of concentrated Hcl in 30-ml water) in a watch glass and kept covered 1/2-5 hours depending on the age of the stain. Normal saline solution 0.9% (Nacl) mixed with 10% glycerin may be used instead of the acidulated water in soaking the stain or preferably a water solution of iodine in order to make the sperms more distinct under the microscope.

2-A drop of the soak solution is put on a slide and allowed to dry or to get nearly dry, then covered with a cover slip.

1- Add beside it a drop of Florence's iodine reagent is made of 2.5 g iodine + potassium iodide 1.5 g in 30 ml water (run under the cover slip).

4- Examine under low power of the microscope:

Result:

- Brown, large, rhombic, irregular, needle shaped evanescent crystals of choline iodide. They are disposed either in clusters, in rosettes or in other varieties of formation. These crystals is similar in shape and appearance to haemin crystals but much larger in size but differ in being evanescent, thus disappearing if left for a short time.

2-Barberio's test

It is preliminary test done by the same technique as the Florence's test but using aqueous saturated solution of picric acid instead of the iodine

solution. A small needle shape and rhombic similar to Charcot Leyden crystals. They may also take the form of small spindles, sometimes crossed longitudinally by a line of refraction, or as ovoid with rounded angles. The large yellow needle-shaped crystals disposed in clusters or rosettes, which are seen at the edges of the preparation, are picric acid crystals.

III- Confirmatory test

1- Microscopical examination

It depends mainly on the presence of spermatozoa in the suspected stain

Procedure:

1- Films are made from the vaginal smear or from the stain solution (the soak solution may be centrifuged and films made from the sediment where the sperms will be aggregated).

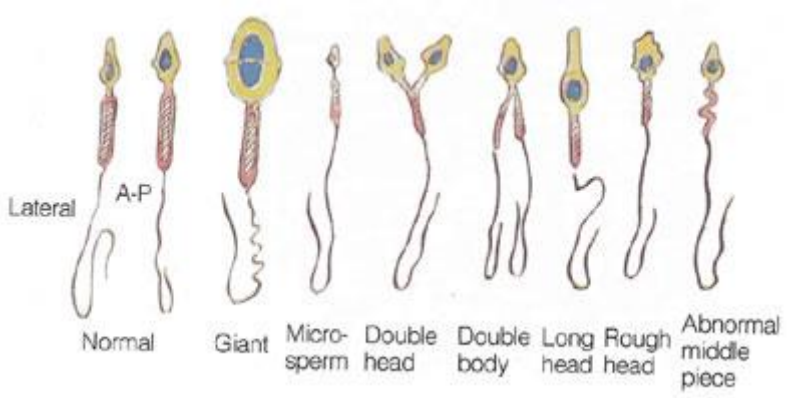
2- The films are lift to dry in the air, fixed with heat in the ordinary way and stained with eosin and methylene blue.

3- Examine under the microscope:

a) The sperms of different animals are quite different in shape and size, both from human sperms and from each other and can be differentiated by an expert.

b) In bestiality crimes at least one complete human sperm must be present. It is composed of head, neck and tail. The head is ovoid, flattened and sometimes rather pointed. The tail is long, tapers to a fine point and is about nine to twelve as long as the head. The tail and proximal part of the head will be stained, while the rest of the head and neck will be stained blue. The whole human sperm measures about 55 microns of which the head is about 5 microns). Separate heads and tails are no proof as the heads of the sperms simulate

cellular debris and the tails simulate minute fibers. In case of azospermia, acid phosphatase test proves the presence of prostate secretion (semen). The discovery of spermatozoa may be made even in very old stains.



Sperm shapes

2- Spermato-precipitin test

In the same way as in blood

Samples

Samples

Samples

Samples

8 Pregnancy Diagnosis and Criminal Abortion

Pregnancy is a period during which female animal carries it's young while this is undergoing development.

Gestation period in different animals:

Animal	Pregnancy period
Cow	283 ± 13 days
Mare	341 ± 11 days
She camel.	375 ± 15 days
She donkey	374 ± 14 days
Pig	120 ± 20 days
Buffaloes	310 ± 10 days
Ewe	148 ± 28 days

Pregnancy diagnosis

1-Suspected signs

a) Physiological signs are cessation of heat, refuse male and changes in habits and characters of the animal.

b) Physical signs are enlargement of the circumstances of the animal and swelling of the mucous membrane of the vagina.

c) Sensible signs as pouring the water in the ears of the female, she will shake the whole body if is not pregnant and it will shake head and ear only if is pregnant.

2-Confirmatory signs

a) Palpation per rectum:

- Fetal membrane slip could be detected 30-35 day in the gravid horn and 70 days in non-gravid horn.
- Amniotic vesicle could be detected at 28 days of pregnancy in heifers and 32-35 days in pluriparous cows.
- Placentomes could be detected 75-80 days of pregnancy.
- Fetus could be detected 65 days of pregnancy.
- Asymmetry of uterine horns, resilience and fluctuation of the uterine wall, fixation of the cervix, hypertrophy of the middle uterine artery and ovarian changes may be supporting signs.

b) Manipulation of the abdomen to sense the movement of fetus.

c) Auscultation of the fetus heart beats.

d) Use of X-ray

e) Ultrasonic waves:

Pregnancy has been diagnosed with 7.5 MHz transducer as early as 9 days after insemination in heifers. The embryonic vesicle could be detected in heifers with 5 MHz transducers by day 13 or 14 and the embryo observed by day 26 -29. The embryo proper was first detected within the amniotic vesicle on day 20 when it was 3.5 mm in length. By day 60 the embryo grows to 66.1 mm between 28-31 forelimb buds became visible approximately 2 days later. Scrotal swelling and teats were detected between days 73 and 120 and the gender of the fetus was determined with accuracy.

Diagnoses of pregnancy in mare

It depends on the following:

1- Rectal examination, rhythmical thrill on palpation of the middle uterine artery indicates pregnancy at the 5 th month.

2- Vaginal examination, vaginal and cervical smear examined microscopically showing ciliated epithelial cells of various shapes.

3- Biological test, it includes gonadotrophic test and estrogen tests.

A- Gonadotrophic test

It depends on the presence of gonadotrophins in the serum of pregnant mare at 50-80 day and then decline until disappears after 150 day. Five ml of serum of suspected mare injected into immature female rat (one dose) or 1/2 ml daily for 3 days.The female rat killed after 4 days from the last dose.Histological changes in the ovaries of the injected rats was seen (G.F. or CL)

B- Estrogen tests

It depends on the presence of estrogen in the urine at 120-150 days, which continue until the 250-day and then decline and disappear at the 290-day of pregnancy.

a) Ascheim-Zondek test

-Injection of 5 immature female rats' 3-4 weeks old by ether treated urine.

-First injection by 0.2 ml, second injection by 0.25 ml and the third injection by 0.2 ml after 12 hours of the second one.

-After 16 hours, (+ ve) pregnancy showing enlargement of the ovary with petechial hemorrhages on the ovarian surface.

b) Friedman test (female rabbit test)

-Injection of 5-10 ml ether treated urine in the ear vein in adult treated rabbit (isolated from male one month), repeat the injection after 24 hrs.

-The animal killed after 12- 13 hrs from the second injection.

-Increase the thickness of the uterine wall and presence of petechial hemorrhages on the ovary indicate (+ ve) pregnancy.

c) Frog test

-Injection of 10 ml of urine treated with ether or acetone in the dorsal lymph sac of a frog.

- Several ova (1000) seen after 5-30 hrs from injection indicate (+ ve) result (pregnancy).

d) Cuboni test (chemical test)

- 3 ml of concentrated HCL + 15 ml of the suspected mare urine, boiling in water bath for 10 minutes, then cooling.
- Add 18-ml benzene (solvent) shakes well for 30 second (two-layer will formed, the estrogen found in the upper layer).
- Separate the benzene layers and adds 5 ml of concentrated sulfuric acid, then boil in water bath at 80 degree for 5 minutes, shaking and cooling.

-Flurensic green color in lower layer containing sulfuric acid.

Diagnosis of pregnancy in cow

1- Rectal examination.

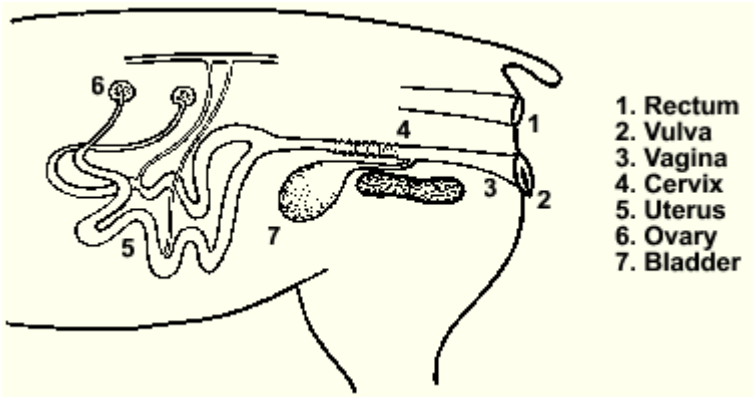
a) Palpation of the uterus (enlargement of the pregnant horn).

b) Palpation of the ovary (corpus luteum).

2-Vaginal examination, from the end of the second month cervix is closed with mucous plug).

3- Biological test

Estrogenic test, which include Allen-Diosy test and Friedman test



a) Allen-Diosy test

- Urine adds concentrated sulfuric acid (free estron in the urine), then extracted by shaking with olive oil, then separate the oil.

-Inject ovarictomised rats by 1/2 ml twice daily for three days (Ovariectomy one month at least before injection).

-Vaginal smear before injection and 96 hours after injection examined microscopically and the presence of cornfield cells I indicate (+ ve) result.

b) Friedman test

-I/P injection of 15 ml of ether treated urine into female rabbit isolated from male at least one month before injection.

- Thickness in the uterine wall is increased and congestion with corrugation.

4- Chemical test:

Progesterone can measured using radioimmuneassays method or any assay kits in laboratory. If progesterone concentrations are low in blood or milk samples taken at 20-24 days after insemination, the cow assumed to be non-pregnant (false positive due to uterine affection should be considered).

5- Bovine pregnancy-specific protein B (bPSPB):

It could be measured by radioimmunoassay as early as 15 days for the detection of pregnancy; this protein is secreted and still increasing in concentration as gestation advances and is detectable until parturition.

Pregnancy diagnosis in different animals

1- Friedman test, It give (+ ve) results after, 45 day from pregnancy in sheep and goat, after 14 day in bitch and after 21- 30 day in pig

2- X- ray, bone and vertebrae of the fetus can be seen.

3- Immunosuppressive early pregnancy factor:

Maternal recognition of pregnancy associated with production of an immunosuppressive agent, a pregnancy-specific protein (early pregnancy factor) may be as early as 48 hours after conception (mice, sheep, humans and mares) in cattle the presence of immunosuppressive early pregnancy factor as early as 24 hours.

Pregnancy diagnosis in dead animals

In late pregnancy, it is easy to see the fetus inside the uterus while in early pregnancy, sectioning of the uterus to see the embryonic cells, which indicates the early pregnancy.

Signs of delivery

1- General signs, the animal is exhausted and looking ill without quick pulse and laxity of the abdominal wall.

2-Special signs (local signs):

a) Swelling and congestion of the external genitalia.

b) The uterus is hard (return to its normal size in few weeks)

c) Bloody fluids from the vulva about 4 days and gradually become pale and white in appearance within 2 weeks.

Medicolegal Aspects of Abortion

Abortion is expulsion of the contents of the gravid uterus at any time before full term.

Types: natural, justifiable and criminal abortion

2- Natural abortion (accidental), occurs usually in the first period of pregnancy due to:

Maternal causes, include all diseases accompanied by pyrexia e.g. brucellosis, FMD, TB etc. Sudden excitement. Uterine diseases e.g. uterine prolapse or uterine displacement. Vitamin E deficiency.

Fetal causes include placental disease e.g. fatty degeneration. Diseases of fetus as congenital malformations or twisted umbilical cord.

3- Justifiable abortion, abortion by the medical practitioner to save the mother's life.

3- Criminal abortion, this is relatively rare in animals and is usually done with the idea of causing loss to the animal's owner due to the presence of enmity.

Methods used for induction of criminal abortion

1- General violence applied externally to the abdominal region.

2- Hard work.

3- Carries heavy loads.

4-Local violence applied to the cervix using catheter, cotton stick or piece of wire or to perforate the fetal membranes, which may lead to uterine contraction and finally lead to abortion.

5-Injection of irritant substances to the uterus as soap or any disinfectant may lead to uterine contraction.

6- Use of drugs which are classified into two groups

a) First group; affect on the uterine muscles directly leading to convulsions, e.g. ergot, estrogen, pituitary extract and lead as irritant poisons.

b) Second group, has a reflex action on the uterus due to its effect on the digestive tract or urinary system, e.g. drastic purgatives as aloes and croton oil, canthridine and metals and their salts which will lead to excitation of the urinary bladder.

7- Using instruments, as syringes, needles and similar probing instruments.

Danger of abortion

1- General violence abortion may lead to fracture or contusions or other affections.

2- Use of drug may lead to toxicity and death.

3- Use of local violence lead to dangerous results as, nervous shock, air embolism, and bleeding or septic infection.

4- Natural abortion usually of good prognosis.

Losses due to abortion

- Loss of the offspring.
- Loss of the mother.
- Decrease in the milk amount or stoppage of its secretion in cases of early abortion.
- Post abortion complications like uterine prolapse, retention of placenta and vaginal prolapse.
- Delayed conception time than normal.
- Repeated abortion.

Samples

Samples

Samples

9 Firearm Weapons & Cartridges

Injuries from firearms are common in Egypt. The veterinarian should be familiar with the different types of fire arms especially those types commonly used in crimes. In a crime we must know:

1- What kind of weapon was used?

2- From what distance the missile was shot.

1- From what direction the firing was made and what were the relative positions of the victim and the assailant.

4- Is the case accident or homicide.

5- If a weapon is seized; is it the weapon used in accident or not. In order to understand and answer these questions one should have a thorough knowledge of the weapons commonly seen and the missiles one is likely to meet with every type of weapon.

I- Types of fire arms:

I- According to the method or the site of loading into:

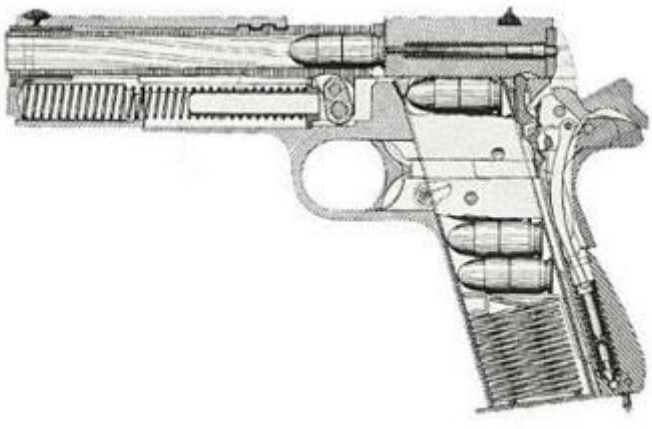
1- Muzzle loaders:

These are guns are filled or loaded through the muzzle (anterior opening). They are obsolete weapons no longer in use nowadays and their interest lies in the historical evolution of the manufacture of weapons and also in the museum. Their loading is usually of the home made variety and consists of different amounts of gun powder of the black type guarded with some wads which are usually pieces of rags of paper and then some homemade shots (cylinders or balls of lead) then the whole with another set of rag wads.

2- Breech loaders:

The gun is usually loaded from its breech end (posterior opening). They are loaded with cartridges made of brass or cartoon of different colors. The cartridges are either machine or home loaded. A cartridge containing the powder, wads, shots and cap into the breech end of the barrel. To fire such a weapon, one simply pulls the trigger (after raising the hammer if there is an external one), when the hammer will strike a needle at the breech block, which in turn strikes the percussion cap of the cartridge, producing the spark and igniting the powder. This group comprises:

A) A 9-mm revolver, swing-out type, with cylinder swung open exposing chambers; **(B)** break-top revolver with action open.



Left side of Colt .45 automatic pistol with manual safety and grip safety (arrow).

a) Rifled weapons,

1- The rifling:

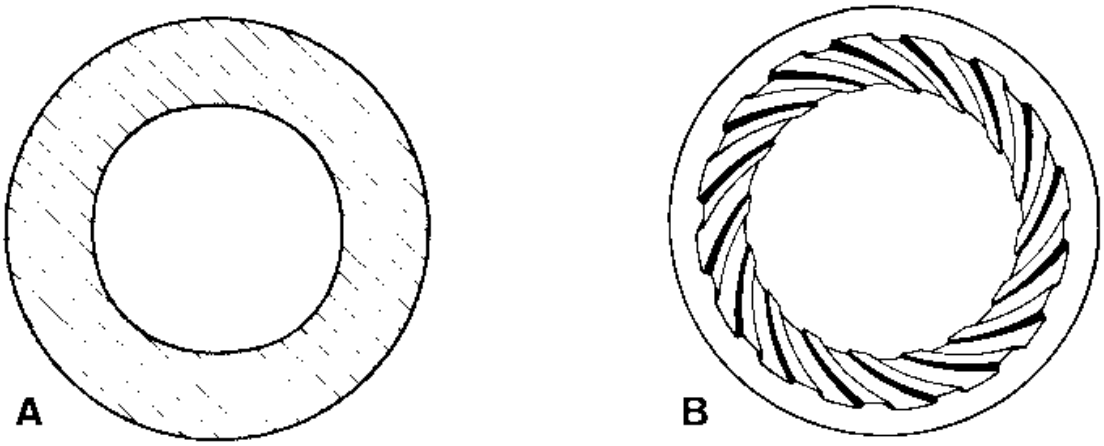
Are the longitudinal ridges alternating with grooves that are running spirally inside the barrel purposely during its manufacture, either in clockwise or anti-clockwise direction.

Function of rifling:

They produce a spinning missile or projectile, to direct the missile fired and gives it more power of penetration and a longer range of firing.

Rifling marks:

These are marks present on the surface of the fired bullets, which help in identification of the causal weapon.



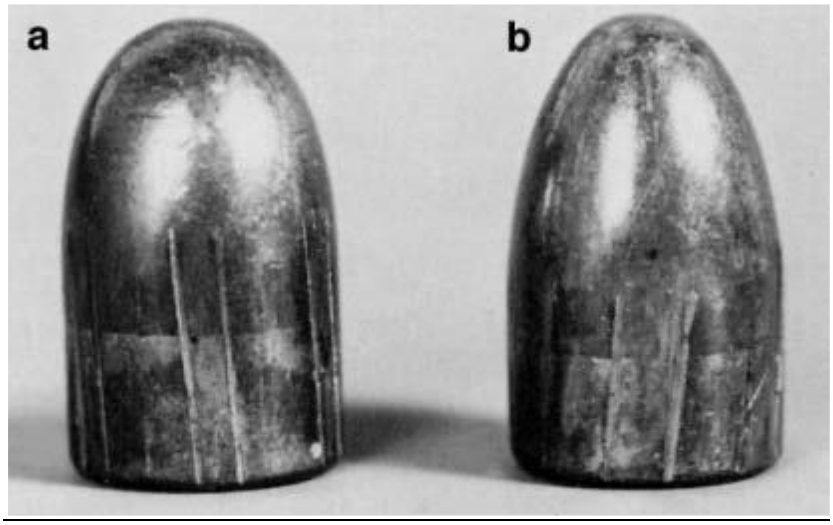
A) Cross-section of barrel showing polygonal rifling. **(B)** Cross section of barrel with micro-groove rifling.

2-They fire bullets (solitary shots).

1- Rifled guns are classified according to the length into:

a) Long, which is Service rifled weapons (automatic-non-automatic).

b) Short, Automatic pistol, which is loaded by automatic manner or Revolver, which is loaded by a revolving magazine (container).



Two 9-mm bullets fired from weapons with (a) left twist and (b) right twist to their rifling.

b) Non-rifled or smooth bored,

1- The non-rifled weapons have a smooth barrel from inside.

2- They fire a collection of shots which may be a machine made or a home made manufacture.

3- The non-rifled weapons are weaker than rifled.

4- They are all-long and include, sporting guns (Automatic sporting guns, which can fire a number of shots) and Gaffer's gun (Greener-Schneider-Remington).

Cartridge of fire arms:

Any cartridge is formed of tube, missile (made of lead), prcussion cap and the gun powder.

Percussion cap, at the base of the tube, is a smaller tube fixed in the centre of the base of the cartridge, which is filled with a paste formed of:

a) Powdered glass (to produce heat on friction).
b) Mercury fulminates (highly inflammable substances).
c) K-chlorate (source of O2).

Gun powder:

There are two types:

a) Black powder: formed of 15% carbon, 10% sulphur and 75% potassium nitrate. When it is ignited it produces 300 volume gases causing high pressure, and leaving an alkaline residue in the form of carbonates, bicarbonates, sulphides and sulphates. In practical examination it is present in the form of black irregular small granules in a small test tube, which are staining the cover of the tube black. It is only present in Ghaffir's gun cartridges.

b) Smokeless powder: formed of nitrocellulose or nitro glycerine. When it is ignited it produces 900 volume gases leaving a neutral residue in the form of nitrites and nitrates. The most common type smokeless powder is called Carotide which is in the form of small brown cords and formed of nitrocellulose or nitroglycerine impregnated in gun cotton and jelly. It may be also in the form of small rods, scales or plates taking any color.

Item	Black powder	Smokeless powder
Composition	15% carbon+10% sulphur+75% nitrates	Nitroglycerine (liquid)+nitrocellulose (solid)
Presence	- Old revolvers Ghaffir's guns (Schneider and Remington) - Shot guns	Service rifles Automatic pistols Recent revolvers Shot guns Ghaffire's guns (Greener)
On ignition	One volume give 300 volume of gases leaving alkaline residues	One volume gives 900 volume of gases, leaving neutral residues.
Date of firing	Can be estimated	Can't be estimated
Types	Black irrigular small granules	- Cordite, brown sticks composed of nitroglycerine, gun cotton and felly. - Scales Amorphus.

Non-rifled Weapon's cartridges:

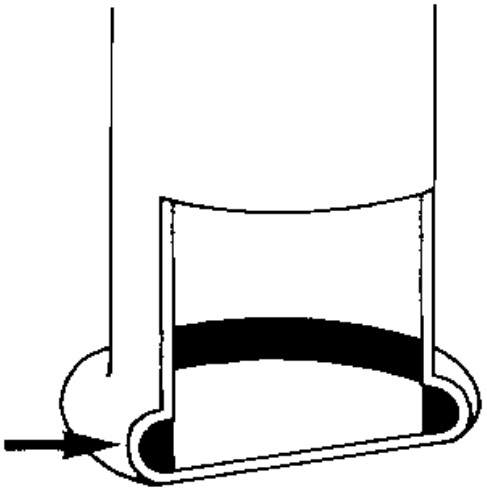
1- The cartridge case is made of cardboard with a brass base and central percussion cap fixed to the base. The cap is a small cylinderical copper container lined from the inside by a paste containing fulminate or cyanate of mercury, potassium chlorate and powdered glass.f such cap is struck by a needle, the mercury fulminate takes fire and a spark is produced.

2- Immediately above the cap there is the powder (black or smokeless).

3- Then the inner wad which is made of felt or thick cardboard.

4- The missile is composed of different number of variable sized shots, depending on the type of intended shooting. The total weight of shots in each cartridge is about 30 g.

5- External wad is mass of cardboard.



Cross-section of base of .22 rimfire cartridge with primer composition in rim of case (arrow).

Results of explosion:

When the trigger of a firearm is pulled the hammer or needle strikes the percussion cap. spark is produced which ignites the powder which results in the production of a great volume of gases (200-300 volumes, per volume of black powder and about 800-900 volumes, per volume of smokeless powder), which try to escape through the only opening in the barrel (muzzle) pushing everything, shots, wads and unburned black powder in front of them. The powder does not always get completely ignited especially in case of black powder when particles of unburned powder are always present.

The explosion products:

1- The gases come out in the form of blast and when entering the body, they expand in all directions cause tearing of the edges of the wound at the entrance. These gases travel for short distance (15 cm in long weapons and much less than this in short weapons.

2- Flame and smoke produce burning and blackening of the body at the entrance, if the weapon has been fired within 1.25 meters in long weapons and less than this in short ones have. These are much less marked in case of smokeless than in case of black powder. The burning is totally absent beyond few centimeters and the smoke does not blacken the target, as in black powder but only gives it a grayish metallic color.

3- The unburned particles of the powder strike the body irregularly resulting in the so-called tattooing. These particles are black in case of black powder and gray minute in smokeless powder. The tattooing reaches about 3 meters in long weapons.

4- The first wad (internal wad) reaches a distance of about 8 to 10 meters and it can penetrate the body at a distance of about 3 meters.

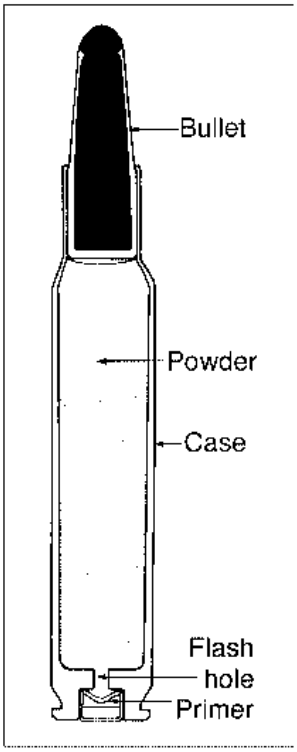
5- The second wad (external wad), is lighter and thus travels for a shorter distance, so that it travel for a distance of about 3 meters and penetrates the body for a distance of about one meter in long weapons.

6- The shots or bullets, cause wounding of the body. The shape of the wound varies with the type of weapon, distance and direction of firing.

Rifled Weapon's cartridges:

It is formed of:

- Long (Service rifle) or short (pistol & revolver) brass tube.
- A long or short bullet made of lead, which is covered, with copper or nickel and it has a pointed end.
- The cartridge may have a rim around the base in case of non-automatic weapons or a groove around the base in case of automatic weapons.
- All rifled weapon's cartridge is filled with smokeless powder.

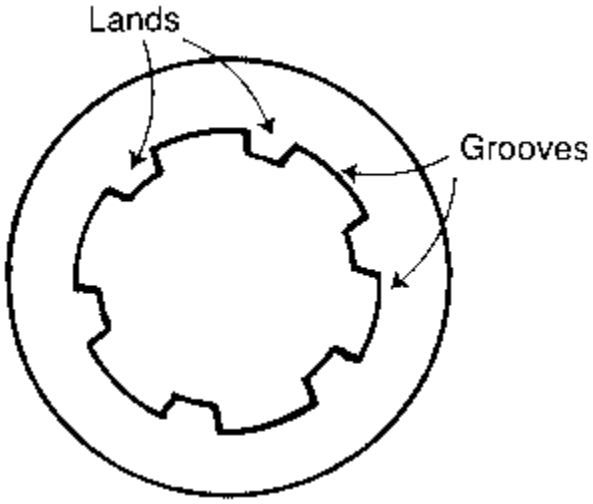


Small arms cartridge with bullet, powder, cartridge, case and primer.

Bore or Caliber (diameter of the barrel):

Caliber of rifled weapons, it is measured directly in mms or fractions of an inch and it equals to the diameter of the base of the bullet.

Caliber of non-rifled weapons, it is measured in relation to balls made of lead and weighs a certain fraction of pound. E.g. Weapon No. 12 it means its diameter equals the diameter of a lead ball weighing 1/12 of a pound.



Cross-section of barrel showing lands and grooves.

Time of discharge of the weapon:

It is possible only in case of black powder. A characteristic smell of burnt powder can be detected in the barrel up to 10-12 days after firing depending on the conditions to which the weapons has been exposed. A rough estimation is by the chemical examination of the residue in the barrel in case of black powder has been used. The muzzle of the weapon would smell strongly of sulphurated hydrogen (chemically detected

within 20-30 minutes, by putting a moistened lead acetate paper over the muzzle of the barrel, if H2S is present the paper gets blackened).

Samples

Samples

Samples

Samples

Samples

Samples

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