FORENSIC TEAM 431

LEDARES

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Simpson's 13th edition

Chapter 5

The appearance of the body after death

- Introduction
- The early post-mortem Interval
- Other post-mortem changes
- Estimation of the post-mortem interval

CRIME SCENE - DO NOT CROSS CRIME

■Slides ■Doctors notes ■Additional

Introduction

It is accepted that, if irreversible cardiac arrest has occurred, the individual has died and eventually all of the cells of the body will cease their normal metabolic functions and the changes of decomposition will begin.

Initially, these changes can only be detected biochemically as the metabolism in the cells alters to autolytic pathways. Eventually the changes become visible and these visible changes are important for two reasons: first, because a doctor needs to know the normal progress of decomposition so that he does not misinterpret these normal changes for signs of an unnatural death and, second, because they may be used in estimating how long the individual has been dead (i.e. the post-mortem interval, or PMI).

The appearance of the body after death reflects PMI-dependent changes, but the reliability and accuracy of traditional ‘markers’ of the PMI has become increasingly doubtful, given their dependence on incompletely understood biological and environmental factors.

The early post-mortem interval

Rapid changes after death

When the heart stops and breathing ceases, there is an immediate fall in blood pressure and the supply of oxygen to the cells of the body ceases. Initially, the cells that can use anoxic pathways will do so until their metabolic reserves are exhausted, and then their metabolism will begin to fail. With loss of neuronal activity, all nervous activity ceases, the reflexes are lost and breathing stops. In the eye the corneal reflex ceases and the pupils stop reacting to light. The retinal vessels, viewed with an ophthalmoscope, show the break-up or fragmentation of the columns of blood, which is called ‘trucking’ or ‘shunting’ as the appearance has suggested the movement of railway carriages. The eyes themselves lose their intraocular tension.

The muscles rapidly become flaccid (primary flaccidity), with complete loss of tone, but they may retain their reactivity and may respond to touch or taps and other forms of stimulation for some hours after cardiac arrest. Discharges of the dying motor neurons may stimulate small groups of muscle cells and lead to focal twitching, although these decrease with time.

The fall in blood pressure and cessation of circulation of the blood usually render the skin, conjunctivae and mucous membranes pale. The skin of the face and the lips may remain red or blue in color in hypoxic/congestive deaths. The hair follicles die at the same time as the rest of the skin and there is no truth in the belief that hair continues to grow after death, although the beard may appear more prominent against a pale skin.

Loss of muscle tone may result in voiding of urine; this is such a common finding that no relationship with deaths from epilepsy or asphyxia can be established. Emission of semen is also found in some deaths, therefore, the presence of semen cannot be used as an indicator of sexual activity shortly before death.

Regurgitation of gastric contents is a very common feature of terminal collapse and it is a common complication of resuscitation. Gastric contents are identified in the mouth or airways in a significant proportion of all autopsies. The presence of such material cannot be used to indicate that gastric content aspiration was the cause of death unless it is supported by eyewitness accounts or by microscopic identification of food debris in peripheral airways in association with an inflammatory response.

Rigor mortis

Rigor mortis is, at its simplest, a temperature-dependent physicochemical change that occurs within muscle cells as a result of lack of oxygen. The lack of oxygen means that energy cannot be obtained from glycogen via glucose using oxidative phosphorylation and so adenosine triphosphate (ATP) production from this process ceases and the secondary anoxic process takes over for a short time but, as lactic acid is a by-product of anoxic respiration, the cell cytoplasm becomes increasingly acidic. In the face of low ATP and high acidity, the actin and myosin fibres bind together and form a gel. The outward result of these complex cellular metabolic changes is that the muscles become stiff. However, they do not shorten unless they are under tension.

It is clear from the short discussion above that if muscle glycogen levels are low, or if the muscle cells are acidic at the time of death as a result of exercise, the process of rigor will develop faster. Electrocution is also associated with rapidly developing rigor and this may be caused by the repeated stimulation of the muscles. Conversely, in the young, the old or the emaciated, rigor may be extremely hard to detect because of the low muscle bulk.

Rigor develops uniformly throughout the body but it is generally first detectable in the smaller muscle groups such as those around the eyes and mouth, the jaw and the fingers. It appears to advance down the body from the head to the legs as larger and larger muscle groups become stiffened.

The only use of assessing the presence or absence of rigor lies in the estimation of the time of death, and the key word here is ‘estimation’, as rigor is such a variable process that it can never provide an accurate assessment of the time of death. Extreme caution should be exercised in trying to assign a time of death based on the very subjective assessment of the degree and extent of rigor. Charts or tables that assign times since death based on the assessment of rigor should be viewed with great scepticism. On its own, rigor mortis has very little utility as a marker of the PMI because of the large number of factors that influence it.

The chemical processes that result in the stiffening of the muscles, in common with all chemical processes, are affected by temperature: the colder the temperature the slower the reactions and vice versa. In a cold body, the onset of rigor will be delayed and the length of time that its effects on the muscles can be detected will be prolonged, whereas in a body lying in a warm environment, the onset of rigor and its duration will be short.

It is also important to be aware of the microenvironment around the body when assessing rigor: a body lying in front of a fire or in a bath of hot water will develop rigor more rapidly than if it were lying outside in winter. When the post-mortem cooling of a body is extreme, the stiffening of the body may result from the physical effects of cooling or freezing rather than rigor. This will become apparent when the body is moved to a warmer environment (usually the mortuary) and the stiffening caused by cold is seen to disappear as the body warms. Continued observation may reveal that true rigor then develops as the cellular chemical processes recommence.

In temperate conditions rigor can commonly be detected in the face between approximately 1 hour and 4 hours and in the limbs between approximately 3 hours and 6 hours after death, with the strength of rigor increasing to a maximum by approximately 18 hours after death. Once established, rigor will remain for up to approximately 50 hours after death until autolysis and decomposition of muscle cells intervenes and muscles become flaccid again. These times are only guidelines and can never be absolute. It is best to test for rigor across a joint using very gentle pressure from one or two fingers only; the aim is to detect the presence and extent of the stiffness, not to 'break' it. If rigor is broken by applying too much force, those muscle groups cannot reliably be tested again.

Cadaveric rigidity

'Cadaveric rigidity' is said to be the stiffness of muscles that has its onset immediately at death and the basis for this concept is the finding of items gripped firmly in the hand of the deceased before the onset of normal rigor. Most cases are said to be related to individuals who are at high levels of emotional or physical stress immediately before death and many reports relate to battlefield casualties, but there are many reports of individuals recovered from rivers with weeds or twigs grasped firmly in their hand or the finger of a suicidal shooting found tightly gripping the trigger. It is suggested that the mechanism for this phenomenon is possibly neurogenic, but no scientifically satisfactory explanation has been given. It is clearly not the same chemical process as true rigor and it is better that the term 'instantaneous rigor' is no longer used as it implies an equivalence with a process for which there is a scientific explanation (Figure 5.1).

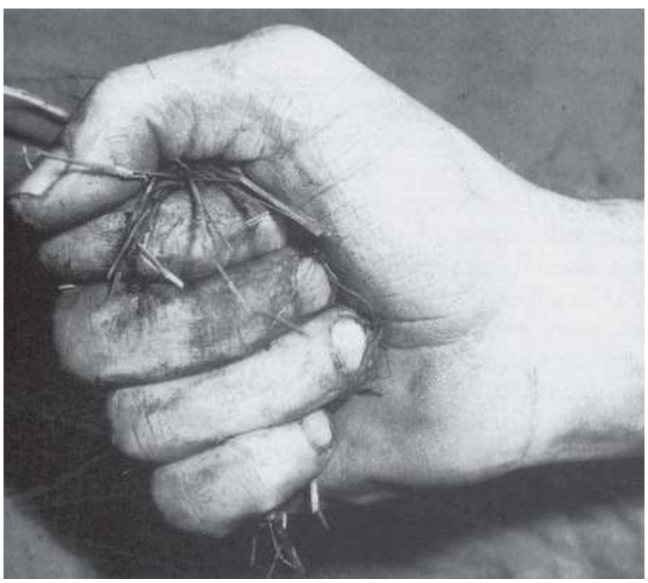

Figure 5.1 Cadaveric rigidity – a rare post-mortem fi nding that may be seen in bodies recovered from water, where vegetation is found tightly 'gripped' in the hand.

Post-mortem hypostasis

Cessation of the circulation and the relaxation of the muscular tone of the vascular bed allow simple fluid movement to occur within the blood vessels. Post-mortem hypostasis or post-mortem lividity are the terms used to describe the visual manifestation of this phenomenon. Theoretically, currents will occur between warmer and colder areas of the body and this may be of importance in the redistribution of drugs and chemicals after death. There is also filling of the dependent blood vessels.

The passive settling of red blood cells under the influence of gravity to blood vessels in the lowest areas of the body is of forensic interest. This results in a pink or bluish colour to these lowest areas and it is this colour change that is called post-mortem hypostasis or lividity. Hypostasis is not always seen in a body and it may be absent in the young, the old and the clinically anaemic or in those who have died from severe blood loss. It may be masked by dark skin colours, by jaundice or by some dermatological conditions.

Post-mortem hypostasis occurs where super ficial blood vessels can be distended by blood. Compression of skin in contact with a firm surface, for example, prevents such distension, and results in areas of relative or complete pallor within hypostasis. Relative pallor within hypostasis may also be caused by pressure of clothing or by contact of one area of the body with another, in which case 'mirror image' pallor may be seen (Figure 5.2).

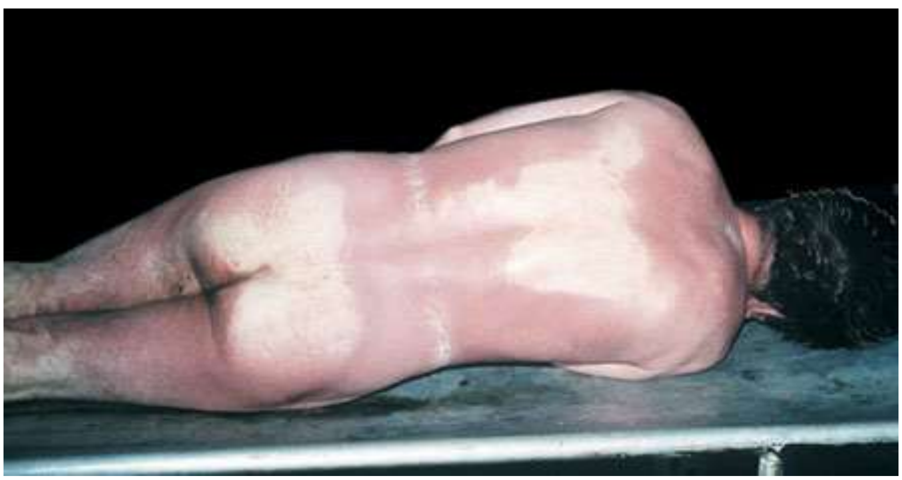

Figure 5.2 Post-mortem hypostasis in a posterior distribution. Areas of pallor can be seen as a result of pressure of the body on a fi rm surface, whereas parts of the body not in direct contact with that surface are purple/ pink because of the 'settling of blood under gravity'. This body has been lying on its back since death.

The site and distribution of the hypostasis must be considered in the light of the position of the body after death. A body left suspended after hanging will develop deep hypostasis of the lower legs and arms, with none visible on the torso (Figure 5.3), whereas a body that has partially fallen head first out of bed will have the most prominent hypostatic changes of the head and upper chest.

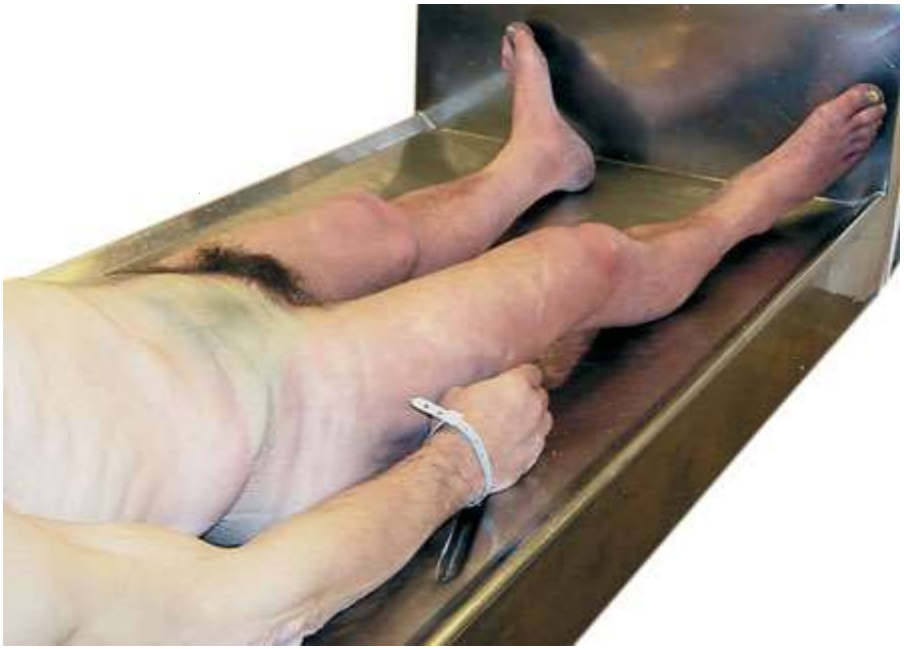

Figure 5.3 Post-mortem hypostasis distribution following hanging. Note the skin discoloration is in the legs and hands because of the vertical body position after death and the green discoloration in the right iliac fossa region.

If a body has laid face downwards, or with the head in a position lower than the rest of the body, hypostasis can cause significant problems for interpretation. Hypostasis in the relatively lax soft tissues of the face can lead to intense congestion and the formation of petechial haemorrhages in the skin of the face, and in the conjunctivae, raising concerns about the possibility of pressure having been applied to the neck. Areas of pallor around the mouth and nose may also add to the impression of pressure having been applied to those areas implying 'suffocation' (Figure 5.4). In such circumstances, the pathologist must attempt to exclude pressure to the mouth, nose and neck as having a role in the death by careful examination and dissection of those structures following removal of the brain and heart, and looking for bruising and skeletal injury.

The colour of hypostasis is variable and may extend from pink to dark pink to deep purple and, in some congestive hypoxic states, to blue. In general, no attempt should be made to form any conclusions about the cause of death from these variations of colour, but there are, however, a few colour changes that may act as indicators of possible causes of death: the cherry pink colour of carbon monoxide poisoning, the dark red or brick red colour associated with cyanide poisoning and infection by Clostridium perfringens, which is said to result in bronze hypostasis.

Bodies stored in refrigerators frequently have pink hypostasis, and while pink hypostasis is also seen in hypothermia victims, they may also have prominent pink/red staining over large joints, the precise cause of which is uncertain, but this may represent haemolytic staining.

Figure 5.4 Post-mortem hypostasis patterns on the front of a body found face down on a bed. The linear marks are formed by pressure from creases in a blanket. Pallor around the mouth and nose are caused by pressure against the bed and do not necessarily indicate marks of suffocation.

The time taken for hypostasis to appear is so variable that it has no reliable role in determining the time of death. Movement of a body will have an effect on hypostasis, as the red blood cells continue to move under the influence of gravity. Even after the normal post-mortem coagulation of the blood has occurred, movement of the red blood cells, although severely reduced, still continues.

This continued ability of the red blood cells to move is important because changes in the position of a body after the initial development of hypostasis will result in redistribution of the hypostasis and examination of the body may reveal two overlapping patterns.

Cooling of the body after death

The cooling of the body after death can be viewed as a simple physical property of a warm object in a cooler environment. Newton's Law of Cooling states that heat will pass from the warmer body to the cooler environment and the temperature of the body will fall. However, a body is not a uniform structure: its temperature will not fall evenly and, because each body will lie in its own unique environment, each body will cool at a different speed, depending upon the many factors surrounding it (Figure 5.5).

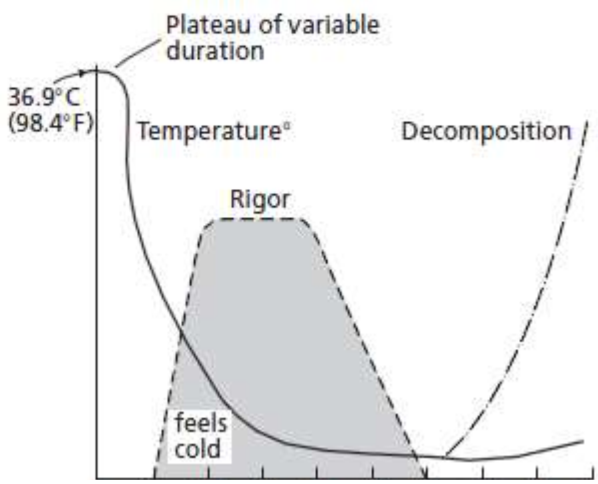

Figure 5.5 The sequence of major changes after death in a temperate environment. Note that the core body temperature does not show a fall for the first hour or so.

In order to use body temperature as an indicator of the time of death the following three basic forensic assumptions must be made:

1. The first assumption is that the body temperature was 37°C at the time of death. However, many factors affect body temperature in life, including variation throughout any 24-hour period (i.e. diurnal variation), exercise, infection and the menstrual cycle.

2. The second assumption is that it is possible to take one, or perhaps a few, post-mortem body temperature readings and, using mathematical formulae, to extrapolate that data and generate a reliable estimate of the time taken by that body to cool to that measured temperature.

3. The third assumption is that the body has lain in a thermally static environment; this is generally not the case and even bodies lying in a confined domestic environment may be subject to the daily variations of the central heating system, while the variations imposed on a body lying outside are potentially so great that no sensible 'average' can be achieved.

Many other variables and factors also affect the rate of cooling of a body (Box 5.1) and together they show why the sensible forensic pathologist will be reluctant to make any pronouncement on the time of death based on the body temperature alone.

Box 5.1 Examples of factors affecting the rate of cooling of a body

- Mass of the body
- Mass/surface area
- Body temperature at the time of death
- Site of reading of body temperature(s)
- Posture of the body – extended or curled into a fetal position
- Clothing – type of material, position on the body – or lack of it
- Obesity – fat is a good insulator
- Emaciation – lack of muscle bulk allows a body to cool faster
- Environmental temperature
- Winds, draughts, rain, humidity

Other post-mortem changes

As the post-mortem interval increases, the body undergoes additional changes that reflect tissue 'breakdown', autolysis and progressive decomposition/ putrefaction.

Decomposition/putrefaction

In the cycle of life, dead bodies are usually returned, through reduction into their various components, to the chemical pool that is the earth. Some components will do this by entering the food chain at almost any level – from ant to tiger – whereas others will be reduced to simple chemicals by autolytic enzymatic processes built into the lysosomes of each cell.

The early changes of decomposition are important because they may be confused by the police or members of the public with the signs of violence or trauma.

Decomposition results in liquefaction of the soft tissues over a period of time, the appearance of which, and the rate of progress of which, is a function of the ambient temperature: the warmer the temperature, the earlier the process starts and the faster it progresses. In temperate climates the process is usually first visible to the naked eye at about 3–4 days as an area of green discoloration of the right iliac fossa of the anterior abdominal wall. This ‘greening’ is the result of the extension of the commensal gut bacteria through the bowel wall and into the skin, where they decompose haemoglobin, resulting in the green colour. The right iliac fossa is the usual origin as the caecum lies close to the abdominal wall at this site. This green colour is but an external marker of the profound changes that are occurring in the body as the gut bacteria find their way out of the bowel lumen into the abdominal cavity and the blood vessels.

The blood vessels provide an excellent channel through which the bacteria can spread with some ease throughout the body. Their passage is marked by the decomposition of haemoglobin which, when present in the superficial vessels, results in linear branching patterns of variable discoloration of the skin that is called ‘marbling’ (Figure 5.6). Over time, generalized skin discoloration occurs and, as the superficial layers of the skin lose cohesion, blisters containing red or brown fluid form in many areas. When the blisters burst, the skin sloughs off.

Figure 5.6 Early decomposition with skin slippage and discoloration. Note the ‘marbling’ representing discoloration owing to decomposition within superficial blood vessels.

Considerable gas formation in soft tissues and body cavities is common and the body begins to swell, with bloating of the face, abdomen, breasts and genitals (Figure 5.7).

The increased internal pressure causes the eyes and tongue to protrude and forces blood-stained fluid up from the lungs which often ‘leaks out’ of the mouth and nose as ‘purge fluid’. Such fluid is frequently misinterpreted by those inexperienced with decomposition related changes as representing injury-associated haemorrhage.

The role of flies and maggots and other animals is discussed below and in Chapter 24, p. 236; domestic animals and other predators are not excluded from this process. As decomposition continues, soft tissues liquefy; however, the prostate and the uterus are relatively resistant to putrefaction and they may survive for months, as may the tendons and ligaments. Eventually, skeletalization will be complete and unless the bones are destroyed by larger animals, they may remain for years.

No reliable ‘timetable’ for decomposition can be constructed because environmental factors may favour enhanced or delayed decomposition, and such factors will generally be unknown to those investigating the death.

Immersion and burial

Immersion in water or burial will slow the process of decomposition. Casper’s Law (or Ratio) states that: if all other factors are equal, then, when there is free access of air, a body decomposes twice as fast than if immersed in water and eight times faster than if buried in earth.

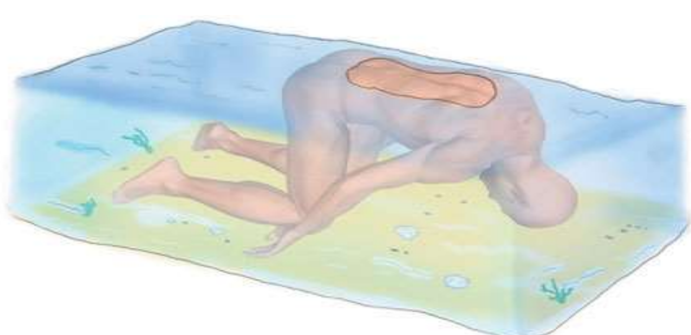

Figure 5.8 Disposition of a body floating in water. Typically the head and limbs hang down, resulting in superficial injuries to the head/ face, back of the arms and hands, knees and top of the feet.

Water temperatures are usually lower than those on land. A body in water may adopt a number of positions, but the most common in the early stage is with the air-containing chest floating uppermost and the head and limbs hanging downwards. Hypostasis follows the usual pattern and affects the head and limbs, and these areas may also be damaged by contact with the bottom if the water is shallow (Figure 5.8)

The first change that affects the body in water is the loss of epidermis. Gaseous decomposition progresses and the bloated body is often, but not always, lifted to the surface by these gases, most commonly at about 1 week but this time is extremely variable. Marine predators will replace the animals found on land and they can cause extensive damage (Figure 5.9). Exposure to water can, in some cases, predispose to the formation of adipocere (see below), but this is unusual unless a body lies underwater for many weeks.

Figure 5.9 Marine creature predation in a body recovered from the North Sea after 3 months. Much of the skin has been removed by crustaceans and the arm muscles by larger fish that have cleaned out most of the body cavity.

The effects and the time-scale of the changes following burial are so variable that little can be said other than buried bodies generally decay more slowly, especially if they are buried deep within the ground. The level of moisture in the surrounding soil and acidity of the soil will both significantly alter the speed of decomposition.

Adipocere

Adipocere is a chemical change in the body fat, which is hydrolysed to a waxy compound not unlike soap. The need for water means that this process is most commonly seen in bodies found in wet conditions (i.e. submerged in water or buried in wet ground) but this is not always the case and some bodies from dry vaults have been found to have adipocere formation, presumably the original body water being sufficient to allow for the hydrolysis of the fat (Figure 5.10).

Figure 5.10 Adipocere formation. Following burial for 3 years, waxy adipocere forms a shell around the skeleton of this infant.

In the early stages of formation, adipocere is a pale, rancid, greasy semi-fluid material with a most unpleasant smell. As the hydrolysis progresses, the material becomes more brittle and whiter and, when fully formed, adipocere is a grey, firm, waxy compound that maintains the shape of the body. The speed with which adipocere can develop is variable; it would usually be expected to take weeks or months, but it is reported to have occurred in as little as 3 weeks. All three stages of adipocere formation can coexist and they can also be found with areas of mummification and putrefaction if the conditions are correct.

Mummification

A body lying in dry conditions, either climatic or in a microenvironment, may desiccate instead of putrefy – a process known as mummification (Figure 5.11). Mummified tissue is dry and leathery and often brown in colour. It is most commonly seen in warm or hot environments such as desert and led to the spontaneous mummification of bodies buried in the sand in Egypt. However, it is not only bodies from hot dry climates that can be mummified, as the microenvironment necessary for mummification may exist anywhere.

Figure 5.11 Mummification. The skin is dry and leathery following recovery from a locked room for 10 weeks.

Mummification of newborn infants whose bodies are placed in cool dry environments (e.g. below floor boards) is common, but adults may also be mummified if they lie in dry places, preferably with a draught. Mummification is, however, much more likely in the thin individual whose body will cool and desiccate quickly.

Mummification need not affect the whole body, and some parts may show the normal soft tissue decomposition changes, skeletalization or formation of adipocere, depending on the conditions. Mummified tissues are not immune to degradation and invasion by rodents, beetles and moths, especially the brown house moth, in temperate climates.

Skeletalization

The speed of skeletalization will depend on many factors, including the climate and the microenvironment around the body. It will occur much more quickly in a body on the surface of the ground than in one that is buried. Generally speaking, in a formally buried body, the soft tissues will be absent by 2 years. Tendons, ligaments, hair and nails will be identifiable for some time after that.

At about 5 years, the bones will be bare and disarticulated, although fragments of articular cartilage may be identified for many years and for several years the bones will feel slightly greasy and, if they are cut with a saw, a wisp of smoke and a smell of burning organic material may be present. Examination of the bone marrow space may reveal residual organic material that can sometimes be suitable for specialist DNA analysis. Examination of the cut surface of a long bone under UV light may assist in dating, as there are changes in the pattern of fluorescence over time.

Dating bones, as with all post-mortem dating, is fraught with difficulty. The microenvironment in which the bone has lain is of crucial importance and the examination and dating of bones is now a specialist subject. If in doubt, the forensic pathologist should enlist the assistance of a forensic anthropologist or archaeologist who has the specialist skills and techniques to manage this type of material.

In the UK, the medico-legal interest in bones fades rapidly if a bone has been dead for more than 70–80 years, because even if it was from a criminal death, it is most unlikely that the killer would still be alive. Carbon-14 dating is of no use in this short time-scale, but examination of the bones for levels of strontium-90, which was released into the atmosphere in high levels only after the detonation of the nuclear bombs in the 1940s, may allow for the differentiation of bones from before and after that time.

Post-mortem injuries

Dead bodies are not immune to injuries and can be exposed to a wide range of trauma, and it is important to bear this possibility in mind when examining anybody so that these injuries are not confused with injuries sustained during life.

Predation by land animals and insects can cause serious damage to the body: if there is any doubt about bite marks, an odontologist should be consulted (Figure 5.12). In water, fish, crustaceans and larger animals can also cause severe damage, but there is the added damage caused by the water-logging of the skin and the movement of the body across the bottom or against the banks.
Contact with boats and propellers will generally lead to patterns of injuries that should be easily recognizable.

Figure 5.12 Post-mortem animal predation. The wound margins of these rat bites are free from haemorrhage or reddening. Such injuries are commonly present around the eyes, ears and nose.

It is not true to say that post-mortem injuries do not bleed because many do leak blood, especially those on the scalp and in bodies recovered from water. The confirmation that a wound is post mortem in origin may be extremely difficult because injuries inflicted in the last few minutes of life and those that were caused after death may appear exactly the same. In general, post-mortem injuries do not have a rim of an early inflammatory response in the wound edges, but the lack of this response does not exclude an injury inflicted in the last moments of life.

Estimation of the post-mortem interval

The pathologist is often asked for an opinion on PMI (the 'time since death') based on the pathological findings. While none of the changes after death is capable of providing a precise 'marker' of PMI, the most reliable would appear to be related to the cooling of the body after death.

Body temperature

Traditionally, the temperature of the body was taken rectally using a long, low-reading thermometer (0–50°C was considered to be adequate). However, there are problems with using this site because any interference with the anus or rectum before a full forensic examination of the area in a good light may confuse or contaminate later investigations into the presence of biological materials such as semen, blood or hair.

The development of small electronic temperature probes with rapid response times and digital readouts has revolutionized the taking of body temperatures. These probes have allowed the use of other orifices, including the nose and ear, although it must be remembered that these areas are unlikely to register the same temperature as the deep rectum or the liver.

Currently, the most useful method of estimating the time of death is Henssge's Nomogram (which is explained in some detail in Box 5.2) (in the book page 51,52). Crucially, the 95 per cent accuracy claimed for this method is, at best, only 2.8 hours on either side of the most likely time (a total spread of over 5.5 hours). Henssge's Nomogram relies on three measurements – body temperature, ambient temperature and body weight – and lack of accuracy in any one of these will degrade the final result. In addition, there is the application of empirical corrective factors to allow for clothing, air movement and/or water (Table 5.1) (in the book page 52) and it should be noted that application of these empirical factors can significantly lengthen the time spans that lie within the 95 per cent confidence limits.

The need to record the ambient temperature poses some problems because pathologists are seldom in a position to do this at the time of discovery and, as their arrival at the scene is often delayed by some tens of minutes or hours, it is most unlikely that the temperature at that time will still be of relevance. Therefore, the first police officers or scientists at the scene should be encouraged to take the ambient temperature adjacent to the body and to record the time that they made their measurement. This, however, may give rise to concerns about interpretation of physical findings (dependent on how and by what route the temperature is taken). An alteration of 5°C in the ambient temperature may lead to, at least, a 1-hour alteration in the most likely time of death.

Many pathologists have in the past used various ‘rules of thumb’ to calculate the time of death from the body temperature but these are generally so unreliable that they should not now be used.

Sometimes the perceived warmth of the body to touch is mentioned in court as an indicator of the time of death; this assessment is so unreliable as to be useless and is even more so if the pathologist is asked to comment upon the reported perceptions of another person.

Various other methods have been researched in as yet unsuccessful attempts to find the hands of the post-mortem clock. Biochemical methods, including vitreous humour potassium levels and changes in enzyme and electrolyte levels elsewhere in the body, have been researched; some remain as interesting research tools but none has been successful in routine work.

Other techniques used in estimating or corroborating PMI

Of considerable value is the work of the forensic entomologist, who can determine a probable time of death – in the region of days to months – from examination of the populations and stages of development of the various insects that invade a body. Initially, the sarcophagus flies – the bluebottle (Calliphora), the greenbottle (Lucilla) and houseflies (Musca) – lay their eggs on moist areas, particularly the eyes, nose, mouth and, if exposed, the anus and genitalia. The eggs hatch into larvae, which grow and shed their skins a number of times, each moult being called an instar (Figure 5.13). Finally, they pupate and a new winged insect emerges. The time from egg laying through the instars to pupation depends on the species and on the ambient temperature, but in general it is about 21–24 days.

Figure 5.13 Maggot infestation of a body recovered from heated premises approximately 2 weeks after death. Forensic entomology may assist in estimating post-mortem interval (PMI) in such cases.

Other animals, both large and small, will arrive to feed on the body, with the species and the rapidity of their arrival depending on the time of year and the environment. The examination of buried bodies or skeletal remains will usually require the combined specialist skills of the forensic pathologist, an anthropologist and an entomologist.

Analysis of gastric contents – other than for toxicological purposes – may occasionally assist in an investigation, where such analysis identifies food components capable of corroborating (or refuting) other evidence that suggests that a particular meal had been eaten at a particular time, but cannot reliably be used to determine time of death. It is important, where time of death may be an issue that all stomach contents are retained for sub sequent analysis.

Forensic mycology, the assessment of fungi, is the other area where some assistance may be gained in determining the time of death in some cases. The use of a range of techniques can all assist the investigator in narrowing down the possible time of death.