

Forensic Science: Fundamentals & Investigations, 2e Chapter 12

### Chapter 12 Death: Manner, Mechanism, Cause



By the end of this chapter you will be able to:

**12.1** Distinguish between cellular death and death of an organism.

**12.2** Distinguish among four manners of death: natural, accidental, suicidal, and homicidal. Explain the fifth classification, undetermined.

**12.3** Distinguish among cause, manner, and mechanism of death.

**12.4** Outline the sequence of events that occurs in the first few minutes after death.

### Chapter 12 Death: Manner, Mechanism, Cause



By the end of this chapter you will be able to:

**12.5** Explain how algor, rigor, and livor mortis develop following death and describe how their development is affected by environmental factors.

**12.6** Sequence and describe the chemical and physical changes during decomposition, including *autolysis, putrefaction, marbling*, and *adipocere* formation.

**12.7** Analyze the evidence from algor, livor, and rigor mortis, stomach contents, and decomposition, along with environmental factors to estimate a postmortem interval.

### Chapter 12 Death: Manner, Mechanism, Cause

By the end of this chapter you will be able to:

**12.8** Compare and contrast the roles of medical examiners and coroners.

**12.9** Describe the procedures of an autopsy, and give examples of how an autopsy helps establish the cause of death, manner of death, and postmortem interval.

**12.10** Support the claim that it is often difficult to pinpoint the postmortem interval.





### Chapter 12 Vocabulary

- algor mortis
- autolysis
- autopsy
- cause of death
- coroner
- decomposition
- livor mortis

- manner of death
- mechanism of death
- medical examiner
- putrefaction
- rigor mortis



### Introduction

- Death of individual body cells is a slow process that does not occur at the exact moment the heart or brain stops.
- A single definition of death is something experts still debate.
- Establishing a postmortem interval (PMI), which is the time between death and body discovery, has great forensic importance.

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### **Manner of Death**

- Official terms for the manner of death include:
  - Natural death caused by interruption and failure of body functions due to age or disease
  - Accidental death caused by unplanned events, such as a car accident
  - Suicidal death a person purposefully kills himself or herself
  - Homicidal death death of one person intentionally caused by another person
  - Undetermined



# Cause and Mechanism of Death

- The cause of death is the reason someone dies ie disease, physical injuries, stroke, poison, heart attack
- The mechanism of death describes the specific change in the body that brought about the cessation of life. Ie if COD is shooting, mechanism may be loss of blood.





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### **Body Changes after Death**

- Death is a sequence of events that affect some cells sooner than others.
  - Stage 1: Stoppage
    - 1. The heart stops, so blood is no longer pumped
    - 2. No circulation leads to no energy for cells
    - 3. Anaerobic respiration occurs
    - 4. Toxic wastes accumulate



### **Body Changes after Death**

- Death is a sequence of events that affect some cells sooner than others.
  - Stage 2: Autolysis, or Cell Self-Destruction
    - Damaged or injured cells release enzymes to rupture the cell membrane

**Figure 12-3** During autolysis, cells self-digest, and fluids leak out, producing some of the leakage of decomposition.





### **Algor Mortis**

- Algor mortis PMI estimates can be accurate for deaths that occurred within the past 24 hours if the corpse has not been subject to unusual heat-loss conditions.
  - For the first 12 hours after death, the body cools at a rate of .78°C (1.4°F) per hour.
  - After the first 12 hours, the body cools about .39°C (.7°F) per hour until the body reaches the same temperature as the surroundings.
  - These rates are an estimate and may vary.



### **Livor Mortis**

- Lividity first becomes noticeable about 2 hours after death.
- The discoloration becomes permanent after 8 hours.
- During autolysis, hemoglobin spills into blood vessels and later pools due to gravity

**Figure 12-4** The location of livor mortis can reveal the position of the body during the first 8 hours after death.



Livor mortis



## **Rigor Mortis**

- Rigor mortis usually becomes apparent within 2 hours after death.
- The stiffness progresses from smaller muscle groups to larger muscle groups.
- After 12 hours, the body is at its most rigid state.

**Figure 12-5** During the first 48 hours of death, the skeletal muscles are stiff—a condition known as rigor mortis.





### Rigor Mortis (continued)

Figure 12-6 Progression of rigor mortis (times vary with environmental factors).

<b>Time After Death</b>	Event	Appearance	Circumstances
2 to 6 hours	Rigor begins	Body becomes stiff and stiffness moves through body.	Stiffness begins in small muscles, such as those of the face, and progresses to larger muscle groups.
12 hours	Rigor complete	Peak rigor is exhibited.	Entire body is rigid.
15 to 36 hours	Slow loss of rigor	Rigor is uneven.	Rigor is slowly lost first in smaller muscles and later in larger muscles.
36 to 48 hours	Rigor absent	Muscles relaxed.	Many variables may extend rigor beyond the normal 36 hours.



### Rigor Mortis (continued)

#### Figure 12-7 Factors affecting rigor mortis.

Factors Affecting Rigor	Event	Effect	Circumstances
Temperature	Cold temperature	Inhibits rigor	Slower onset and slower progression of rigor
	Warm temperature	Accelerates rigor	Faster onset and faster progression of rigor
Activity before death	Anaerobic exercise	Accelerates rigor	Lack of oxygen to muscle, buildup of lactic acid, and higher body temperature accelerates rigor.
	Sleep	Slows rigor	Fully oxygenated muscles exhibit rigor more slowly.
Body mass	Obese	Slows rigor	Fat stores oxygen.
	Thin	Accelerates rigor	Body loses oxygen quickly.



### Autopsy

- An autopsy is a medical examination to determine the cause and manner of death.
- Clinical autopsies are done for medical research study purposes and foul play is not considered.
- Forensic autopsies are performed when foul play is suspected.
  - External examination
  - Internal examination



### Autopsy

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- External examination
- Photograph and X-ray
- Examination of clothes etc
- External surface examined
- Swabbing of hands
- Alternative light source to examine any body secretions
- Wounds examined and measured
- Fingerprints are taken
- Physical traits are identified

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### Autopsy

Internal examination



# Stomach and Intestinal Contents

- Within 2 to 6 hours, the stomach empties its contents into the small intestines.
- Within 12 more hours, the food leaves the small intestine.
- Within about 24 hours, the wastes are released through the rectum.

**Figure 12-8** The state of undigested food provides a clue to the postmortem interval.





### **Stages of Decomposition**

#### **Figure 12-9** The stages of decomposition provide information about time of death.

Stage	What Happens During Decomposition
1. Fresh (initial)	Corpse appears normal on the outside, but is starting to decompose from the actions of bacteria and autolysis. The body temperature drops. Insects lay eggs.
2. Bloating (putrefaction)	Odor of decaying flesh is present, and the corpse appears swollen. The skin becomes marbled in color- ation and may split open from collected gases, resulting in fluid seepage. Insect activity increases.
3. Active decay (black putrefaction)	Very strong odor. Flesh is discolored. Skin is rupturing, allowing gases to escape and body to collapse while seepage of fluid continues. Most body mass is lost to insect activity at this stage.
4. Advanced decay	Corpse is drying out. Most flesh is gone. Adipocere is forming. Fewer insects remain.
5. Dry or skeletal	Mostly bones remain.



### Stages of Decomposition (continued)

### "Rule of Thumb" PMI estimate

- Body feels warm and is flaccid (dead less than 3 hours)
- Body feels warm and is stiff (dead 3-8 hours)
- Body feels cold and is stiff (dead 8-36 hours)
- Body feels cold and is flaccid (dead more than 36 hours)





## Summary

- Death is a process that involves both individual cell death and organism death. The medical and legal communities have been unable to agree upon a precise definition of death.
- When a person dies, it is important to establish the manner, cause, and mechanism of death. An exact time since death, or postmortem interval (PMI), is sometimes difficult to estimate.



### Summary (continued)

- Shortly after death, the body undergoes algor, rigor, and livor mortis. The rate at which they occur is affected by environmental and physiological factors such as ambient temperature, clothing, body mass, age, state of disease, and burial site (if any) of the body.
- Physical and chemical changes that occur after death, such as bloating, skin marbling, and adipocere formation, are caused by decomposition. The process begins with autolysis of cells, is followed by putrefaction, and proceeds to the total degradation of soft tissues.



### Summary (continued)

- Autopsies are typically performed by medical examiners. During an autopsy, the medical examiner performs external and internal examinations, images various pertinent body regions, removes and weighs organs, and takes tissue and fluid samples from organs, often including the eye, stomach, liver, and brain.
- To estimate a postmortem interval, evidence is compiled from the body, the environment, the autopsy findings, and the person's social contacts, if necessary. A PMI is never precise because of the many environmental variables and other factors that influence what happens to a body after death.