This Photo by Unknown Author is licensed under CC BY-NC-ND

Environmental

Cold Emergencies

South Cook County EMS

Continuing Education

February 2025

Introduction

- Environmental emergencies
  - Medical conditions caused or worsened by weather, terrain, fauna, or unique atmospheric conditions at high altitude or underwater

Introduction

- Certain weather conditions affect one's ability to adapt to the environment:
  - Wind
  - Rain
  - Snow
  - Temperature extremes
  - Humidity

Introduction

- Common risk factors predispose people to environmental emergencies.
  - Preexisting conditions
  - Younger and older people
  - Dehydration
  - Overall health and fitness

This Photo by Unknown Author is licensed under CC BY-NC-ND

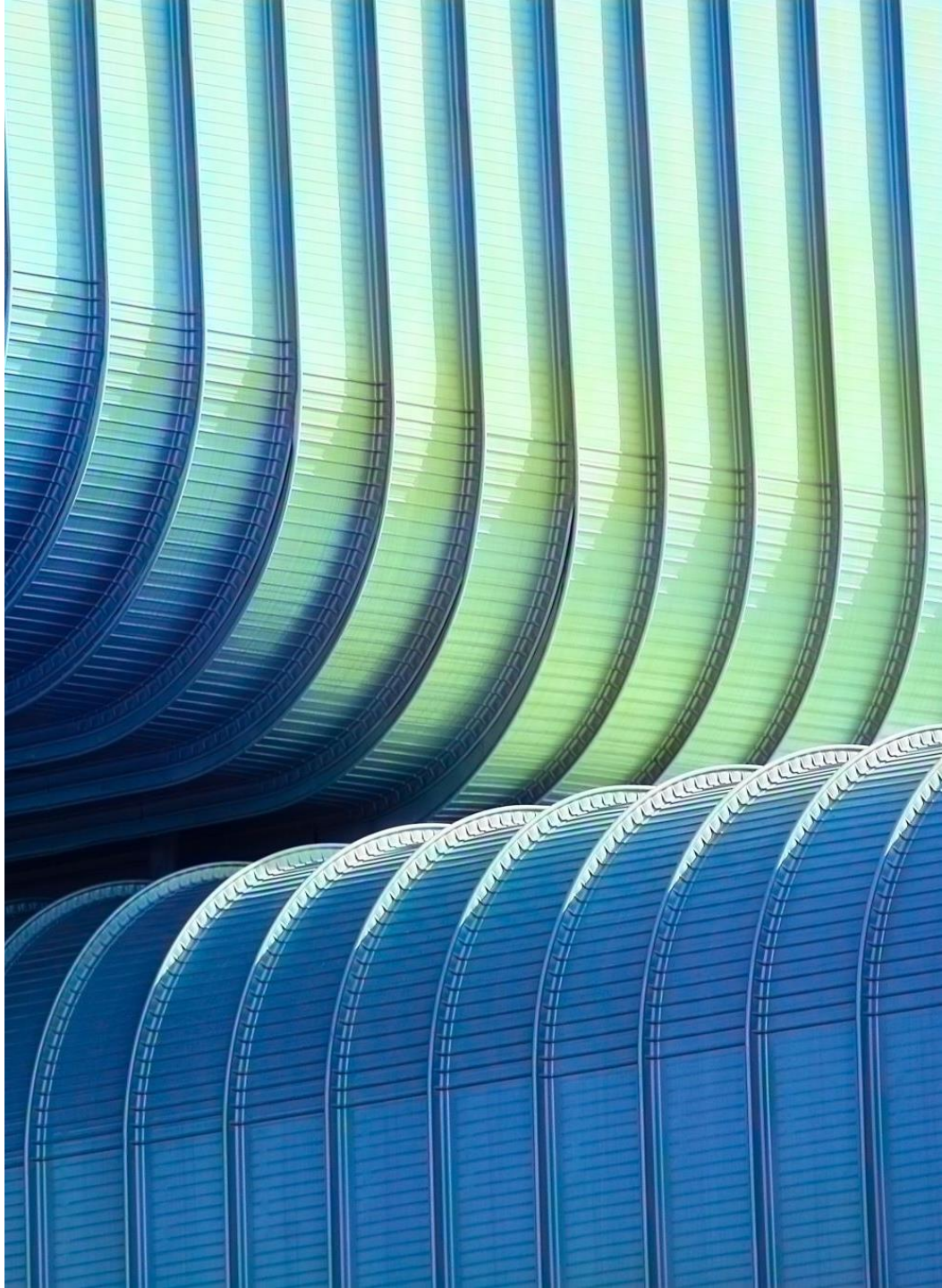
Homeostasis and Body Temperature

Homeostasis

- Body processes that balance supply and demand of the body's needs

Thermoregulation

- Thermosensitive neurons in the anterior hypothalamus balance heat production and dissipation.



Homeostasis and Body Temperature

The body tries to keep a temperature of 98.6°F.

Periphery temperatures in the skin and extremities fluctuate.

Definitions for starting temperatures include:

- Hypothermia: decreased CBT starting at 95°F
- Hyperthermia: elevated CBT starting at 100.4°F

Homeostasis and Body Temperature

Oral temperature can vary dramatically from CBT if the patient is:

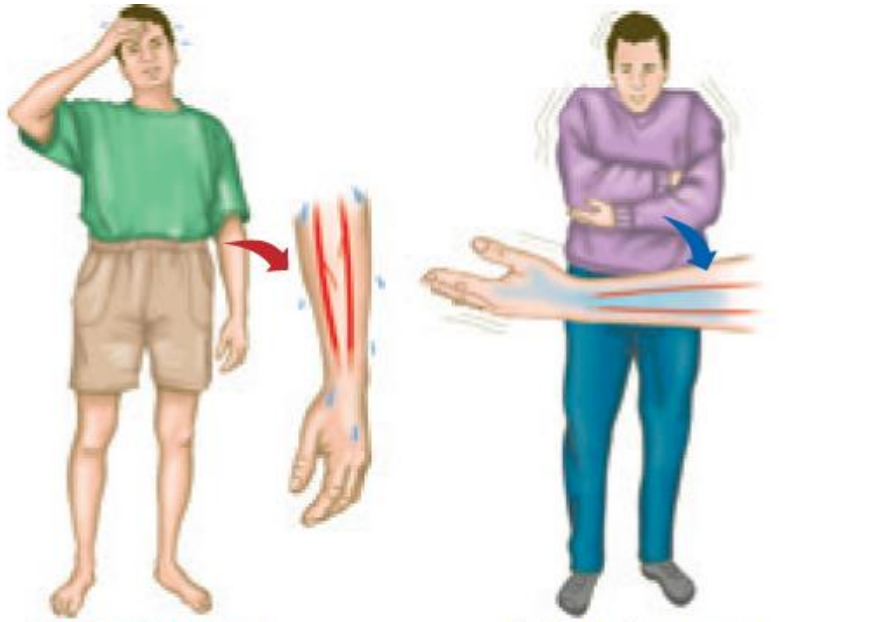
- Breathing by mouth
- Drinking hot or cold liquids

Rectal temperatures are generally more reliable.

Tympanic temperatures may be more appropriate for field operations.

Thermoregulatory Mechanisms (1 of 6)

- Hypothalamus hosts the main thermoregulatory center.



© Jones & Bartlett Learning.

Thermoregulatory Mechanisms

At rest, the body produces heat by metabolism of nutrients.

Basal metabolic rate (BMR) is heat energy produced at rest from normal body metabolic reactions.

Thermoregulatory Mechanisms

- BMR of average 70-kg person is around 70 kcal/hour, based on factors including:
  - Age
  - Sex
  - Stress
  - Hormones

Thermoregulatory Mechanisms

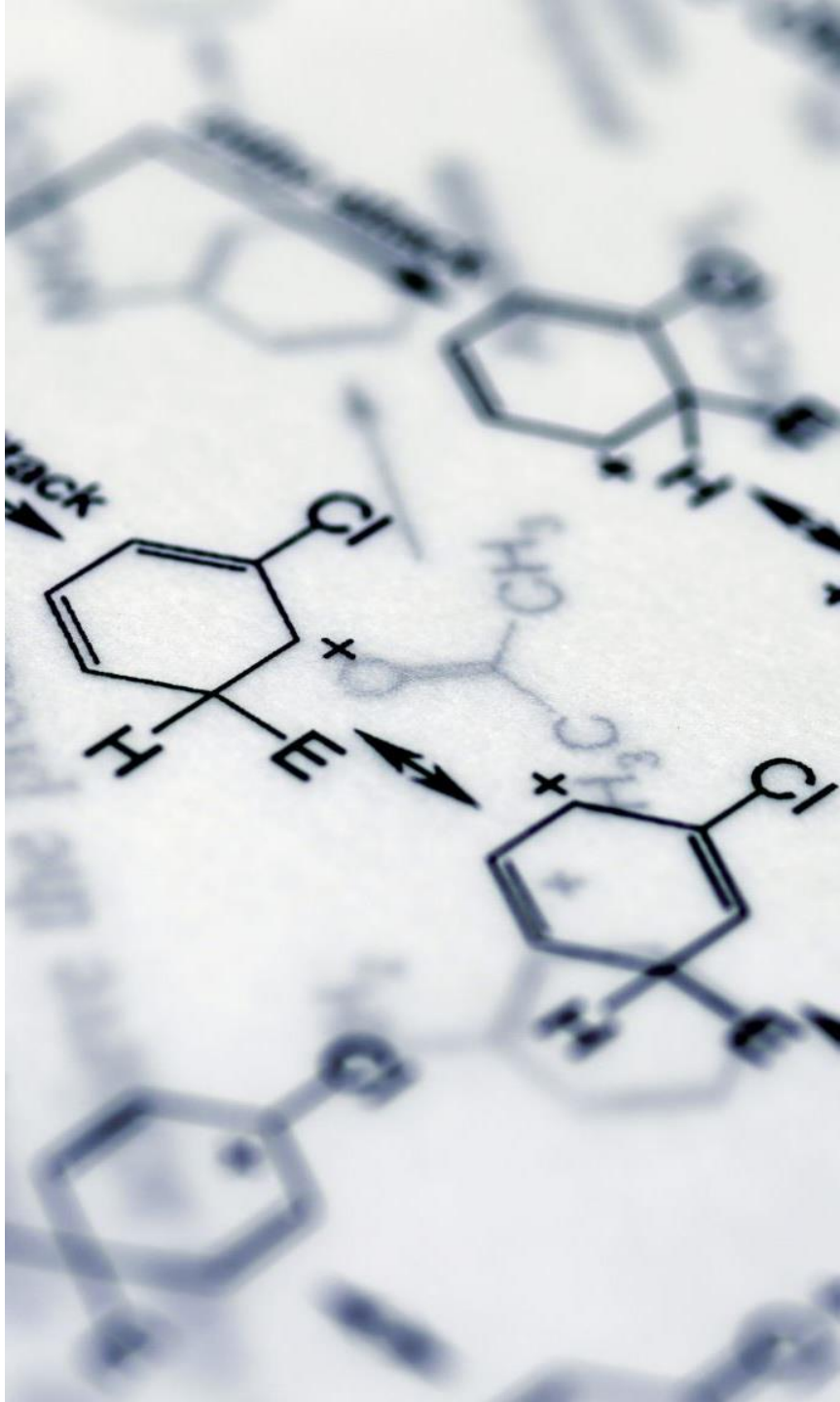
Heat loss to the environment increases as the ratio of body surface area to body volume increases.

- With two people of the same weight, the taller will have a higher BMR.

Exertion affects metabolic rate.

Thermoregulatory Mechanisms

- Heat generated by metabolism and glycogen breakdown warms the body.
  - Excess heat is dissipated by the temperature gradient between the body and the outside environment.
  - If environmental temperatures are higher, the body heats by absorption of outside heat.



Thermoregulatory Mechanisms

- Skin plays a vital role in body temperature regulation.
  - Conserves and liberates heat energy through skin by regulating blood flow

This Photo by Unknown Author is licensed under CC BY-NC-ND

Local Cold Injury/Frostbite

- Usually localized to extremities or exposed areas
- Frostbite
  - Superficial thickness
  - Partial thickness
  - Full thickness

© Dr. P. Marazzi/Science Source

Local Cold Injury/Frostbite

Deeper degrees of frostbite: tissue freezes

Risk factors:

- Cold exposure without adequate clothing
- Impeding circulation to extremities
- Fatigue, dehydration, or hunger
- Direct contact with cold objects
- Hypothermia

© American Academy of Orthopaedic Surgeons.

© American Academy of Orthopaedic Surgeons.

Local Cold Injury/Frostbite

- Superficial frostbite
  - Altered sensation of numbness, tingling, and burning
  - Skin condition:
    - Waxy and white
    - Firm to palpation
  - Thawing causes:
    - Cyanotic skin
    - Hot, stinging sensation

Courtesy of Neil Malcom Winkelmann.

Local Cold Injury/Frostbite

- Deep frostbite
  - White, yellow-white, or mottled blue-white skin
  - Feels hard, cold, without sensation
  - Major damage when tissues thaw
    - Area turns purple and is painful

Courtesy of Dr. Jack Poland/Centers for Disease Control and Prevention.

Local Cold Injury/Frostbite

- Management
  - It is difficult to determine the depth of injury.
  - Reperfusion injury can be excruciating.
  - Treatment is determined by the distance to the hospital and whether the affected area is partially or completely thawed.
    - Rapid rewarming is difficult in the field.

This Photo by Unknown Author is licensed under CC BY

Local Cold Injury/Frostbite

- General principles:
  - Remove from cold and remove wet clothing.
  - Do not rub or massage area.
  - Transport with injured area elevated.
  - Give pain medication as needed.
  - Cover blisters with a dry, sterile dressing.
  - Consider rewarming if there is no potential of refreezing.

Local Cold Injury/Frostbite

- Principles of rewarming:
  - Rewarm before transport if medical control agrees.
  - Water bath—immersion without touching container
  - Temperature between 102°F and 104°F
  - IV analgesia

This Photo by Unknown Author is licensed under CC BY-SA

Trench Foot and Chilblains

- Trench foot
  - Similar to frostbite but can occur at temperatures as high as 60°F
  - Caused by prolonged exposure to cool, wet conditions
  - Best treatment: prevention

This Photo by Unknown Author is licensed under CC BY-ND

Trench Foot and Chilblains

- Chilblains
  - Itchy reddish or purple lesions on face or extremities
  - Long exposure to temperature just above freezing
  - Treatment:
    - Remove from extreme environments.
    - Rewarm at room temperature.

Figure 1: A case of impressive chilblains.

Figure legend: Violaceous plaques with diffuse borders spanning the dorsal side of right fingers.

This Photo by Unknown Author is licensed under CC BY

Hypothermia

- Decrease in CBT starting at 95°F due to:
  - Inadequate thermogenesis
  - Excess environmental cold stress

© Andy Barrand, *The Herald Republican*/AP Photo.

Hypothermia

- Hypothermic condition results from:
  - Cold temperatures
  - Fatigue
  - Improper gear
  - Wetness and dehydration
  - Length of exposure
  - Intensity of weather conditions

This Photo by Unknown Author is licensed under CC BY

Hypothermia

- Alcohol predisposes patients to hypothermia.
  - Impairs shivering thermogenesis
  - Promotes cutaneous vasodilation
  - Inadequate glycogen stores from liver disease
  - Subnormal nutritional status
  - Impairs judgment

Hypothermia

- Others at risk include:
  - Those using sedative medications
  - Those using tricyclic antidepressants
  - Those using phenothiazines
  - Older patients
  - Trauma patients

This Photo by Unknown Author is licensed under CC BY-NC-ND

Hypothermia

- National Institutes of Health campaign: watch for “umbles” in early stages:
  - Stumbles
  - Mumbles
  - Fumbles
  - Grumbles
  - Crumbles

This Photo by Unknown Author is licensed under CC BY-SA-NC

Hypothermia

- 2019 WMS practice guidelines
  - Mild hypothermia: CBT between 95°F and 90°F
  - Moderate hypothermia: CBT between 90°F to 82°F
  - Severe hypothermia: CBT below 82°F

This Photo by Unknown Author is licensed under CC BY

Hypothermia

- Classifications:
  - Acute
  - Subacute
  - Chronic
- Also classified as:
  - Primary
    - Caused by cold exposure
  - Secondary
    - Caused by problems such as sepsis

This Photo by Unknown Author is licensed under CC BY-NC

Hypothermia

- There is no strong correlation between specific CBT and signs and symptoms.
- Body systems react in different ways.
  - In the CNS, everything slows
- Signs and symptoms may resemble:
  - Stroke
  - Head injury
  - Acute psychiatric disturbance
  - Alcohol intoxication

Hypothermia

Muscular system slows.

- Initial reaction is shivering.
- Shivering stops at around 91°F.
- Cold muscles become progressively weaker and stiffer.

Cold affects body’s metabolism.

Hypothermia

- Care is aimed at preventing more heat loss and rewarming.
  - Strip the patient of wet clothes.
  - Insulate the patient from further heat loss.
  - Use warm blankets and heat packs also known as passive rewarming.

This Photo by Unknown Author is licensed under CC BY-NC-ND