Environmental Emergencies
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<td>Convection</td>
<td>Radiation</td>
</tr>
</tbody>
</table>
4 mechanisms of heat loss

**Convection**
Body heat is lost to surrounding air, which becomes warmer, rises, and is replaced with cooler air.

**Evaporation**
Perspiration or wet skin results in body heat lost when the fluid evaporates.

**Radiation**
Body heat is lost to the atmosphere or nearby objects without physically touching them.

**Conduction**
Body heat is lost to nearby objects through direct physical touch.
4 mechanisms of heat loss

**Conduction:**
- Direct transfer (object → object)
- Ex: sitting on snow or rock

**Convection:**
- Transfer through circulating fluid (air / liquid)
- Ex: wind chill

**Evaporation:**
- Process where liquid becomes a vapor
- Ex: sweating

**Radiation:**
- Emission of infrared heat
- May account for 60% + heat loss

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**Wind chill**
The apparent temperature felt on exposed skin; a function of air temperature and wind speed
Thermoregulation:

- The process of maintaining normal body temperature
- 1st response to cold: constrict peripheral blood vessels + shunt blood from ext.

Chief factors that can predispose a person to cold injury?

- Alcohol (veins dilate, more warm blood reaches skin surface)
- Age (body fat + blood flow decrease)
- Others: previous frostbite, overexertion, poor-fitting clothes, dehydration, impaired circulation
**Frostbite**: damage to tissues from freezing due to formation of ice crystals between and within cells, rupturing cells and leading to cell death.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial (frostnip, chillblains)</td>
<td>affects top layer of skin, no permanent damage</td>
</tr>
<tr>
<td><strong>Partial thickness frostbite</strong></td>
<td>affects upper layers of skin, minor damage to tissues</td>
</tr>
<tr>
<td><strong>Full thickness frostbite</strong></td>
<td>affects all layers of skin, plus muscle + even bone; severe damage/death of tissues</td>
</tr>
</tbody>
</table>
**Definitions**

**Hypothermia**: abnormally low body temperature; below 95 F

- Primary: results from environmental exposure; immersion vs. non-immersion
- Secondary: occurs with systemic disorders, traumatized patients.

**Afterdrop**: a continued drop in core temperature after removal from cold exposure (cold blood → through body)

**Windburn**: irritation of skin; resembles sunburn; drying effect of low humidity
# Frostbite - Assessment

<table>
<thead>
<tr>
<th>Condition</th>
<th>Signs / Symptoms</th>
</tr>
</thead>
</table>
| Superficial (frostnip / chillblains) | • Cool, pale skin  
• Pain  
• Tissues remain intact |
| Partial thickness frostbite       | • White / gray colored patches  
• Not painful  
• Indents when pressed  
• Minimal tissue loss |
| Full thickness frostbite          | • White / gray tissue  
• Numb  
• Cold / woody skin -- will not indent if pressed  
• No pulse can be detected |
Frostbite - Management

- Key: rapid warming
  - Can cause pain
- Only warm if no possibility of refreezing
  - Refreezing frostbitten tissue will become gangrenous → tissue death
- Frostbitten body part: in sheltered area where entire body can be kept warm
  - Immerse in warm water bath for 20-30 mins; do not rub
## Hypothermia - Assessment

<table>
<thead>
<tr>
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<th>Signs / Symptoms</th>
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</thead>
</table>
| **Mild Hypothermia**  | ● Shivering (increases muscle activity, starts at 96.8 F)  
                       | ● Alert but may be confused  
                       | ● Body temp below 95 F |
| **Moderate Hypothermia** | ● Shivering stops (90 F),  
                            | ● Diminished metabolism, pulse, respirations, LOR  
                            | ● Surface temp of skin drops |
| **Severe Hypothermia** | ● Core temps near 77 F → patient appears dead  
                          | ● Rigid without palpable pulse / respirations  
                          | ● Suppression of energy dependent processes → explain possible resuscitation of hypothermic patients. |
Hypothermia - Management

**General / Mild**

- Key: Prevent heat loss
  - Relocation to heated building
  - If not possible, insulate from ground, wool hat, vapor barrier
- Remove any wet clothing
- Warming methods
  - Hot packs to major arterial sites → not directly to skin)
  - Warm drinks + high energy foods

**Moderate / Severe**

- Handle gently
- Supine position
- Rapid transport
- No drinks w / A.M.S.
- No rubbing extremities
- No full-body immersion
- “Not dead until warm and dead”
Heat-Related Emergencies
Body discharges excess heat through...
  ○ Sweating (evaporative heat loss)
  ○ Dilation of blood vessels in skin (radiant heat loss)

**Humidity**: amount of water vapor in the air. Slows evaporation

**Heat index**: a measure of risk for heat illness; combines the effects of increasing ambient temperature / increasing humidity

**Hyponatremia**: dilution of sodium level in the blood
  ○ Overhydration

**Hyperthermia**: elevated core body temperature
Four forms of heat illness

- Heat-related Syncope
- Heat Cramps
- Heat Exhaustion
- Heat Stroke
<table>
<thead>
<tr>
<th>Heat-Related Syncope</th>
<th>Heat Cramps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signs / Symptoms</strong></td>
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</tr>
<tr>
<td>● Warm to touch</td>
<td>● Intense painful muscle spasms</td>
</tr>
<tr>
<td>● Lightheaded</td>
<td>● Unrelenting pain / cramps</td>
</tr>
<tr>
<td>● Tachycardia</td>
<td></td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td><strong>Management</strong></td>
</tr>
<tr>
<td>● Be aware of injuries from falling</td>
<td>● Electrolyte solutions</td>
</tr>
<tr>
<td>● Supine position (blood → brain)</td>
<td>● Gentle stretching / massaging</td>
</tr>
<tr>
<td>● Remove from heat</td>
<td>● Rest</td>
</tr>
<tr>
<td>● Cool liquids*</td>
<td></td>
</tr>
</tbody>
</table>
# Heat Exhaustion

<table>
<thead>
<tr>
<th>Signs / Symptoms</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Weakness</td>
<td>● Move to cooler / shadier area</td>
</tr>
<tr>
<td>● Headache</td>
<td>● Supine position</td>
</tr>
<tr>
<td>● Confusion</td>
<td>● Loosen clothing</td>
</tr>
<tr>
<td>● Nausea</td>
<td>● Fan patient</td>
</tr>
<tr>
<td>● Faintness / Lightheadedness</td>
<td>● Rehydrate with cool electrolyte solution</td>
</tr>
<tr>
<td>● Tachycardia</td>
<td>● Transport to hospital (symptoms that don’t clear,</td>
</tr>
<tr>
<td>● Warm skin</td>
<td>decreasing LOR)</td>
</tr>
<tr>
<td>● <em>Moderate to heavy sweating</em></td>
<td></td>
</tr>
</tbody>
</table>
# Heat Stroke

## Signs / Symptoms
- Altered level of consciousness
- Hot, dry, flushed skin
- Sweating mechanisms have been exhausted

## Management
- Notify EMS → rapid transport
- Move to cooler / shadier area
- Remove clothing
- Supplemental oxygen
- Convection and evaporation cooling (keep skin wet with continuous flow of air)
- Ice packs to armpits and groin
Lightning Strikes

**Signs / Symptoms**

- Feathering / ferning of skin
- Muscular contractions
- Respiratory arrest (injury to brainstem)
- Cardiac arrest (electrical current through heart)
- Neurologic effects (pain, paralysis, blindness, numbness)
- External burns at enter / exit strikes

**Management**

- Remember: patient not electrically charged
- Open airway
- CPR, AED
- High flow oxygen with BVM

Sophie “Lightning” Leiter