Environmental Emergencies

- **Heat**
  - "Excited" molecular state
    - Molecules vibrate
    - Increased vibration equals increased heat
    - Decreased vibration equals less heat
- **Cold**
  - Absence of heat
  - Low state of molecular excitation

- **Thermal gradient**
  - Heat flow
    - High temperature to low temperature
    - Molecules placed next to excited molecules tend to gain some of the vibration at the expense of the warmer molecule
    - Low temperature molecules will not move heat to a warmer object

- **Body heat**
  - Presence of excited molecular state in body tissues
  - **Sources**
    - **Intrinsic**
      - Metabolism
        - CHO+O2 = Energy (ATP)+H2O+CO2+HEAT
        - Metabolism (normal)
        - Thermogenesis (generation of heat)
        - Increased rate of metabolism
    - **Extrinsic**
      - Infrared radiation
      - Heat gradient
        - Ambient temperature
        - Relative humidity
      - Relative degree of infrared

- **Losses (Thermolysis)**
  - Radiation (55%)
    - Body radiates infrared radiation
      - Depends on blood near skin surface
      - The greater the amount of blood near the skin surface, the greater the heat loss
• Evaporation (24%)
  - State change from liquid to gas
  - Requires energy
  - Energy removed from body
• Convection (10%)
  - Thermal gradient
  - Contact with airflow
  - Gain heat if air warmer than body

- Losses (Cont.)
• Conduction (5%; percentage increases dramatically in water)
  - Thermal gradient
  - Direct, physical contact with object
  - Gain heat if object warmer than body
• Respiration (5%)
  - Thermal gradient
  - Warm air
  - Water vapor
  - Heat gained if air inhaled warmer than body
    » Has been used as treatment for hypothermia
• Elimination of solid and liquid wastes (1%)
  - Heat lost during elimination
    » Feces
    » Urine

• Regulation
  - Nervous
  • Skin
    - Vasodilation (most important)
    - Sweating
  • Respiration (dogs)
    - Gas heating
    - Water vapor
  • Hypothalamus
    • Pyrexia (febrile)
      - Inflammatory
      - Environmental
      - Secondary CNS effect

• Compensation
  - Body "balances" heat loss and heat gain
- Temperature
  • Normal core temp
    - 98.6 F
    - 37 C
    - Peripheral tissues may be at different temperature than core organs

- Compensation (Cont.)
  - Hypothermia
    • 1 degree or more less than normal body core temperature
  - Hyperthermia
    • 1 degree or more greater than normal body core temperature

- History
  - Source
  - Environment
  - Loss of consciousness
  - Effects
    • General
    • Local

**Hypothermic Emergencies**

- Generalized hypothermia
  - Predisposing factors
    • Cold environment
      - Immersion
      - Non-immersion
  - Age
    - Very old
      » Difficulty regulating own body temperature
    - Very young
      » Infants and young children are small with large surface area.
      » Small muscle mass, so shivering is poor in children and not at all in infants
      » Less body fat
      » Younger children need help to protect self (cannot put on or take off clothes)

- Generalized hypothermia
  - Predisposing factors (Cont.)
  - Medical conditions
    » Shock (hypoperfusion)
    » Head injury
    » Burns
    » Generalized infection
    » Injuries to the spinal cord
» Diabetes and hypoglycemia
  • Drugs/poisons

• Generalized hypothermia
  - Environmental conditions of cold exposure
    • Obvious exposure
    • Subtle exposure
    • Ethanol ingestion
    • Underlying illness
    • Overdose/poisoning
    • Major trauma
    • Outdoor resuscitation
    • Ambient temperature decreased (e.g. home of elderly patient)

• Signs and symptoms of generalized hypothermia
  - Decreasing mental status or motor function
    • Poor coordination
    • Memory disturbances
    • Reduced or loss of sensation - to touch
    • Mood changes
    • Speech difficulty
    • Poor judgment - patient may actually remove clothing

• Signs and symptoms of generalized hypothermia (Cont.)
  - Musculo-skeletal signs & symptoms
    • Stiff or rigid posture
    • Muscular rigidity
    • Shivering may be present or absent
    • Shivering halts when glucose reserves are depleted
    • Complaints of joint and/or muscle stiffness

• Signs and symptoms of generalized hypothermia (Cont.)
  - Cool/cold skin temperature - the EMT-Basic should place the back of his hand between the clothing and the patient's abdomen to assess the general temperature of the patient. The patient experiencing a generalized cold emergency will present with cool abdominal skin temperature.
    • Skin color
      • Red, pale, cyanotic
      • Stiff/hard

• Signs and symptoms of generalized hypothermia (Cont.)
  - Breathing variations
    • Early - rapid breathing
    • Late - shallow, slow or even absent breathing
  - Pulse
• Early - rapid
• Late - slow and barely palpable and/or irregular, or completely absent
  - Low to absent blood pressure
  - Slowly responding pupils

• Emergency medical care for generalized hypothermia
  - Airway
    - Halt further cooling
      • Remove the patient from the cold environment
      • Remove wet clothing and cover with blankets.
      • Handle the patient extremely gently.
        - Rough handling can cause onset of ventricular tachycardia

• Emergency medical care for generalized hypothermia (Cont.)
  - Breathing
    • Administer oxygen if not already done as part of the initial assessment - oxygen administered should be warmed and humidified, if possible.
  - Circulation
    • Do not allow the patient to walk or exert himself.
    • Assess pulses for 60 seconds before starting CPR.
    • DO NOT DEFIBRILLATE MORE THAN THREE TIMES UNTIL CORE TEMP IS GREATER THAN 86 DEGREES FAHRENHEIT
    • IV normal saline at 75 cc/hr

• Emergency medical care for generalized hypothermia (Cont.)
  - Glucose check
    • Administer D50W if indicated
    • If the patient is alert and responding appropriately, actively rewarm.
      • Warm blankets
      • Heat packs or hot water bottles to the groin, axillary and cervical regions.
      • Turn the heat up high in the patient compartment of the ambulance.

• Emergency medical care for generalized hypothermia (Cont.)
  - If the patient is unresponsive or not responding appropriately, rewarmed passively:
    • Warm blankets
    • Turn the heat up high in the patient compartment of the ambulance.
  - Do not allow the patient to eat or drink stimulants.
  - Do not massage extremities.

• Local cold injuries
  - Localized to specific area of body
  - Predisposing factors
    • Tend to occur on the extremities and exposed ears, nose, and face.
• Signs and symptoms of local cold injuries
  - Early or superficial injury
    • Blanching of the skin - palpation of the skin in which normal color does not return.
    • Loss of feeling and sensation in the injured area.
    • Skin remains soft.
    • If rewarmed, tingling sensation

• Signs and symptoms of local cold injuries (Cont.)
  - Late or deep injury
    • White, waxy skin
    • Firm to frozen feeling upon palpation
    • Swelling may be present.
    • Blisters may be present.
    • If thawed or partially thawed, the skin may appear flushed with areas of purple
      and blanching or mottled and cyanotic.

• Emergency medical care for local cold injuries
  - Remove the patient from the environment.
  - Protect the cold injured extremity from further injury.
  - Administer oxygen if not already done as part of the initial assessment.
  - Remove wet or restrictive clothing.

• Emergency medical care for local cold injuries (Cont.)
  - If early or superficial injury
    • Remove jewelry.
    • Splint extremity.
    • Cover the extremity.
    • Do not rub or massage.
    • Do not re-expose to the cold.
  - If late or deep cold injury
    • Remove jewelry.
    • Cover with dry clothing or dressings.
    • Do not:
      - Break blisters
      - Rub or massage area
      - Apply heat
      - Rewarm
      - Allow the patient to walk on the affected extremity

• Emergency medical care for local cold injuries (Cont.)
  - When an extremely long or delayed transport is inevitable, then actively & rapidly re-
    warm.
• Immerse the affected part in warm water bath.
• About 110 degrees F
• Monitor the water to ensure it does not cool from the frozen part.
• Continuously stir water.
• Continue until the part is soft and color and sensation return.
• Dress the area with dry sterile dressings. If hand or foot, place dry sterile dressings between fingers or toes.
• Protect against refreezing the warmed part.
• Expect the patient to complain of severe pain.

Hypertermic Emergencies

• Exposure to Heat
  - Predisposing factors
    • Climate
      - High ambient temperature reduces the body's ability to lose heat by radiation.
      - High relative humidity reduces the body's ability to lose heat through evaporation.
    • Exercise and activity
      - Can lose more than 1 liter of sweat per hour.
      - Loss of electrolytes (sodium, chloride and fluid through sweat).

• Exposure to Heat
  - Predisposing factors (Cont.)
    • Age
      - Elderly
        » Poor thermoregulation
        » Medications
        » Lack mobility - can not escape hot environment.
      - Newborn/infants
        » Poor thermoregulation
        » Cannot remove own clothing

• Exposure to Heat
  - Predisposing factors (Cont.)
    • Pre-existing illness and/or conditions
      - Heart disease
      - Dehydration
      - Obesity
      - Fever
      - Fatigue
      - Diabetes
    • Drugs/medications
• Heat Cramps
  - Pathophysiology
    • Hot environment
    • Increased activity
    • Increased sweating
    • Salt loss
    • Muscular cramping due to hyponatremia
  - Assessment
    • High ambient temperature
    • History of increased activity
    • History of massive sweating

• Heat cramps
  - Signs and symptoms
    • Cramps
      - Fingers
      - Hands
      - Arms
      - Calf muscles
      - Abdominal muscles
    • Weakness or exhaustion
    • Dizziness or faintness
    • Moist, pale, normal to cool temperature skin
    • Tachycardia
    • Possible nausea
    • Usually normal LOC

• Emergency medical care of heat cramps.
  - Remove the patient from the hot environment and place in a cool environment (back of air conditioned ambulance).
  - Administer oxygen if not already done during the initial assessment.
  - Loosen or remove clothing.
  - Cool patient by fanning.
  - Put in supine position with legs elevated.
  - If patient is responsive and is not nauseated, have the patient drink water with slight salt or Gatorade.
  - If the patient is unresponsive or is vomiting, transport to the hospital with patient on his left side.
  - IV Normal Saline

• Heat stroke
  - Pathophysiology
    • Hot environment
    • High humidity
    • Decreased evaporation of sweat
    • Increased body temperature
• Increased metabolism
• Further increase in body temperature
• Systemic hyperthermia with resulting physiologic effects
  - Increased cell permeability
  - Potassium loss (hypokalemia)
  - Dysrhythmias
  - Massive vasodilation
  - CNS effects

• Heat stroke
  - Signs and symptoms
  • Decreased LOC
  • Hot skin
  • Red skin
  • Early tachycardia
  • late bradycardia
  • Hypotension
  • Early tachypnea
  • Late bradypnea
  • Seizures

• Emergency medical care of heat stroke.
  - Airway
  - Breathing
  - Administer oxygen if not already done during the initial assessment.
  - Halt further heating
    • Remove the patient from the hot environment and place in a cool environment
      (back of air conditioned ambulance with air conditioner running on high).
    • Remove clothing.

• Emergency medical care of heat stroke (Cont.)
  • Apply cool packs to neck, groin and armpits.
  • Keep the skin wet by applying water by sponge or wet towels.
  • Fan aggressively.
    - Transport immediately.

Water-related Emergencies

• Near-drowning
  - Pathophysiology
    • Anoxia secondary to immersion
• Types of Water
  - Fresh
    • No diluted salts
    • Massive hemodilution
    • Erythrocytes "explode"
  - Salt
    • High diluted salt content
    • No massive hemodilution
    • Blood cells remain normal

- Water in lungs
  • Dry
    - No water aspirated into lungs
  • Wet
    - Water in lungs

- Water temperature
  • Cold water
    - Lowers metabolic demands
    - Not dead until warm and dead
      » Longest known survivor was submerged 62 minutes
  • Warm water
    - Elevates metabolic demands

• Combinations
  - "Best"
    • Dry-salt-cold
  - "Worst"
    • Wet-fresh-warm

• Emergency medical care of near-drowning
  - Ensure the safety of the rescue personnel.
  - Suspect possible spine injury if diving accident is involved or unknown.
  - Consider length of time in cold water drowning. Any pulseless, non-breathing patient who has been submerged in cold water should be resuscitated.

• Emergency medical care of near-drowning (Cont.)
  - In-line immobilization and removal from water with backboard if spine injury is suspected and patient is responsive.
  • May begin ventilations in water, but not chest compressions
  - If there is no suspected spine injury, place patient on left side to allow water, vomitus and secretions to drain from upper airway.
  - Suction as needed.
• Emergency medical care of near-drowning (Cont.)
  - Ventilate with high flow O₂.
  - If gastric distention interferes with artificial ventilation, the patient should be placed on his left side. With suction immediately available, the EMT-Basic should place his hand over the epigastric area of the abdomen and apply firm pressure to relieve the distention. This procedure should only be done if the gastric distention interferes with the ability of the EMT-Basic to artificially ventilate the patient effectively.

• Emergency medical care of near-drowning (Cont.)
  - Check and maintain pulse
    • May use AED if adult victim
    • IV normal saline TKO (may use INT)
  - 20 cc/kg bolus if hypotensive
  - Supine position
  - Emergently transport

• Bites and Stings
  - Signs and symptoms
    • History of bite (spider, snake) or sting (insect, scorpion, marine animal)
    • Pain
    • Redness
    • Swelling
    • Weakness
    • Dizziness
    • Chills
    • Fever
    • Nausea/vomiting
    • Bite marks
    • Stinger

• Bites and Stings
  - Emergency medical care
    • Airway
    • Breathing
    • Circulation
      - If stinger present, remove it.
        » Scrape stinger out; e.g., with edge of card.
        » Avoid using tweezers or forceps as these can squeeze venom from the venom sac into the wound.
    • IV normal saline TKO (may use INT).
    • 20 cc/kg bolus if hypotensive.
    • Remove jewelry from injured area before swelling begins, if possible.
    • Place bite site slightly below the level of the patient's heart.
- Emergency medical care (Cont.)
  - Do not apply cold to snakebites.
  - Consult medical direction regarding constricting band for snakebite.
    » Band placed between bite site and heart
    » Make sure distal pulse remains
  - Gently wash affected area.
  - Observe for development of signs and symptoms of anaphylaxis; treat as needed.

Behavioral Emergencies

- Behavior
  - Behavior - manner in which a person acts or performs; any or all activities of a person, including physical and mental activity.
  - Behavioral Emergency - a situation where the patient exhibits abnormal behavior within a given situation that is unacceptable or intolerable to the patient, family or community.
  - Abnormal behavior can be due to extremes of emotion leading to violence or other inappropriate behavior or due to a psychological or physical condition such as lack of oxygen or low blood sugar in diabetes. ALWAYS TRY TO RULE OUT A PHYSICAL CAUSE.

- Behavioral Change
  - Common physical causes for behavior alteration.
    • Low blood sugar
    • Lack of oxygen
    • Inadequate blood flow to the brain
    • Head trauma
    • Mind altering substances
    • Excessive cold
    • Excessive heat

Bipolar Disorder

- Formerly known as manic-depression.
- Recurrent episodes of significant disturbance in mood ranging from debilitating depression to unbridled mania.

- Onset of symptoms generally occurs in young adulthood.
- Episodes of illness are associated with distress and disruption, and a relatively high risk of suicide.
• Usually treated with medications and/or therapy or counseling.
• The mainstay of medication are a number of drugs termed “mood stabilizers”

• Common drugs used to treat bipolar disorder
  - Lithium
  - Depacon
  - Depaken

Schizophrenia

• Most severe psychiatric disorder
• Characterized by impairments in the perception or expression of reality

• Signs and Symptoms
  - Auditory hallucinations
  - Paranoid or bizarre delusions
  - Disorganized speech and thinking
  - Significant social or occupational dysfunction.
  - Delusions
  - In severe cases, the patient may be
    • Mute
    • Remain motionless in bizarre postures
    • Exhibit purposeless agitation

• Common drugs used to treat schizophrenia
  - Largactil
  - Thorazine
  - Risperdal
  - Prolinx
  - Compazine
  - Mellari
  - Stelazine
  - Vesprin
  - Haldol

Clinical Depression

• Common psychiatric disorder, characterized by a persistent lowering of mood, loss of interest in usual activities and diminished ability to experience pleasure.
• Said another way, a persistent sense of deep sadness.
• Can be a once in a life-time event or have multiple recurrences, it can appear either gradually or suddenly, and either last for few months or be a life-long disorder.
• Having depression is a major risk factor for suicide; in addition, people with depression suffer from higher mortality from other causes.

• Signs and symptoms
  - Persistent deep sadness or "empty" mood
  - Loss of appetite and/or weight loss, or conversely overeating and weight gain
  - Insomnia, early-morning awakening, or oversleeping
  - Restlessness or irritability
  - Feelings of worthlessness, inappropriate guilt, helplessness
  - Feelings of hopelessness, pessimism

• Signs and symptoms (Cont.)
  - Difficulty thinking, concentrating, remembering, or making decisions
  - Loss of interest or pleasure in hobbies and activities that were once enjoyed, including sex
  - Decreased energy, fatigue, feeling "slowed down" or sluggish
  - Persistent physical symptoms that do not respond to treatment, such as headaches, digestive disorders, and chronic pain
  - Thoughts of death or suicide or attempts at suicide

• Common drugs used to treat clinical depression
  - Prozac
  - Paxil
  - Lexapro
  - Esipram
  - Celexa
  - Zoloft
  - Wellbutrin
  - Zyban.
  - Augmentor Drugs (increases effectiveness of foregoing drugs)
    • Tryptan
    • Buspar

• Assessing Behavioral Emergency Patients
  - Identify yourself and let the person know you are there to help.
  - Inform him of what you are doing.
  - Ask questions in a calm, reassuring voice.
  - Allow the patient to tell what happened without being judgmental.
  - Show you are listening by rephrasing or repeating part of what is said.
  - Acknowledge the patient's feelings.
  - Assess the patient's mental status.
    • Appearance
• Activity
• Speech
• Orientation for time, person, and place

• Assessing for Suicide Risk
  - Risk factors may include:
    • Individuals over 40, single, widowed or divorced, alcoholic, depressed.
    • A defined lethal plan of action which has been verbalized.
    • Unusual gathering of articles which can cause death such as purchase of a gun, large volumes of pills, etc.
    • Previous history of self-destructive behavior.
    • Recent diagnosis of serious illness.
    • Recent loss of significant loved one.
    • Arrest, imprisonment, loss of job.
    • Other psychiatric illness.

• Assessment of Potential Violence
  - Scene size-up
    - Check with family and bystanders to determine if the patient has a known history of aggression or combativeness.
  - Posture - stands or sits in a position which threatens self or others. May have fists clinched or lethal objects in hands.
  - Vocal activity - is yelling or verbally threatens harm to self or others.
  - Physical activity - moves toward caregiver, carries heavy or threatening objects, has quick irregular movements, muscles tense.

• Emergency medical care
  - Scene size-up, PERSONAL SAFETY
    • NEVER LET THE PATIENT GET BETWEEN YOU AND YOUR MEANS OF ESCAPE
  - Calm the patient
  - Restrain if necessary. Consider need for law enforcement.
  - DO NOT LEAVE THE PATIENT ALONE
  - Transport
  - If overdose, bring medications or drugs found to medical facility.

• Methods to Calm Behavioral Emergency Patients
  - Acknowledge that the person seems upset and restate that you are there to help.
  - Inform him of what you are doing.
  - Ask questions in a calm, reassuring voice.
  - Maintain a comfortable distance.
  - Encourage the patient to state what is troubling him.
  - Do not make quick moves.
  - Respond honestly to patient's questions.

• Methods to Calm Behavioral Emergency Patients (Cont.)
- Do not threaten, challenge or argue with disturbed patients.
- Tell the truth, do not lie to the patient.
- Do not "play along" with visual or auditory disturbances of the patient.
- Involve trusted family members or friends.
- Be prepared to stay at scene for a long time. Always remain with the patient.
- Avoid unnecessary physical contact. Call additional help if needed.
- Use good eye contact.

• Sometimes, nothing works and non-consenting, agitated patients must be transported for their own good.

• Medical/Legal Considerations
- How to handle the patient who resists treatment

TCA 33-6-401. Emergency detention. —
IF AND ONLY IF
(1) a person has a mental illness or serious emotional disturbance, AND
(2) the person poses an immediate substantial likelihood of serious harm under § 33-6-501 because of the mental illness or serious emotional disturbance,
THEN
(3) the person may be detained under § 33-6-402 to obtain examination for certification of need for care and treatment.

TCA 33-6-402. Detention without warrant authorized. —
If an officer authorized to make arrests in the state, a licensed physician, a psychologist authorized under § 33-6-427(a), or a professional designated by the commissioner under § 33-6-427(b) has reason to believe that a person is subject to detention under § 33-6-401, then the officer, physician, psychologist, or designated professional may take the person into custody without a civil order or warrant for immediate examination under § 33-6-404 for certification of need for care and treatment.

TCA 33-6-501. “Substantial likelihood of serious harm” defined.
IF AND ONLY IF
(1) (A) a person has threatened or attempted suicide or to inflict serious bodily harm on the person, OR
(B) the person has threatened or attempted homicide or other violent behavior, OR
(C) the person has placed others in reasonable fear of violent behavior and serious physical harm to them, OR
(D) the person is unable to avoid severe impairment or injury from specific risks, AND
(2) there is a substantial likelihood that the harm will occur unless the person is placed under involuntary treatment,
THEN
(3) the person poses a “substantial likelihood of serious harm” for purposes of this title.

• Restraining Patients
- Restraint should be avoided unless patient is a danger to self and others. When using restraints have police present, if possible, and get approval from medical
direction. If restraints must be used, do the following:
• Be sure to have adequate help.
• Plan your activities.
• Use only the force necessary for restraint.
• Estimate range of motion of patients' arms and legs and stay beyond range until ready.
• Once decision has been made - act quickly.
• Have one EMT talk to patient throughout restraining.

Restraining Patients (Cont.)
• Approach with four persons, one assigned to each limb all at the same time.
• Secure limbs together with equipment approved by medical direction.
• Secure to stretcher with multiple straps.
• Cover face with surgical mask if spitting.
• Document indication for restraining patients and technique of restraint.
• Avoid unnecessary force.
• REASSESS BREATHING AND CIRCULATION FREQUENTLY.

• After the patient is on the stretcher?
  - Video

• Police and medical direction involvement
  - Seek medical direction when considering restraining a patient.
  - Ask for police assistance if during scene size-up the patient appears or acts aggressive or combative.
• Protection against false accusations
  - Documentation of abnormal behavior exhibited by the patient is very important.
  - Have witnesses in attendance especially during transport, if possible.
  - Accusing EMTs of sexual misconduct is common by emotionally disturbed patients - have help, same sex attendants, and third party witnesses.