- **Homeostasis**
  - A system that keeps things the same (roughly). Think “thermostat.”
    - Water
    - Salt
    - Temperature
  - Hypothalamus
  - Fever
  - basal metabolic rate
  - core vs. periphery
  - body heat reservoir
  - Countercurrent heat exchange: deep vs superficial veins
  - heat loss physical modes:
    - conduction,
    - convection,
    - radiation,
    - evaporation, and
    - respiration

- **Heat:**
  - Heat Edema: duh
  - Heat Syncope: duh
  - Dehydration
    - Heat adaptation and sweat concentration
    - Symptoms of dehydration (thirst from hypernatremia mostly)
- Symptoms of salt depletion (hyponatremia): heat-hyponatremia
- Urine color
- Rehydration: oral better, Gatorade, salty lemonade, salt in food, salt tablets?

- **Heat Cramps**
  - ? role of potassium

- **Heat Exhaustion**
  - ? definition: spectrum
  - Rest, rehydration, not an emergency.

- **Heatstroke**
  - How to measure temperature:
    - Esophageal?
  - Dry skin needed to dx?
  - Two kinds: exertional and nonexertional? Role of DM, neuropathy, meds?
  - DIC, liver and kidney failure, brain damage, shock, rhabdo and myoglobinuria
  - Treatment: rapid cooling, immersion or mist and fan (shirt off is better)

- **Cold**
  - Chilblain
  - Trench Foot (immersion foot)
  - Frostnip (first degree frostbite)
  - Frostbite
    - Predisposing factors:
- (2°: clear blisters, 3°: bloody blisters, 4°: muscle and bone)
- Superficial: 1°-2°; Deep: 3°-4°
- "it's OK to walk on frostbitten feet"
- Barron Larrey: rubbing with snow instead of heating with fire
- Best rewarming: rapid (37°C to 39°C = 98.6°–102.2°F); not refreezing; slow better than no rewarming
- Heatpacks on hands OK for rearming hypothermia too: goes directly back to core.

**Hypothermia**
- Survival: see handout
- Predisposing factors
- Diagnosis (hand in armpit)
  ◆ Incipient hypothermia
  ◆ Mild
  ◆ Deep: metabolic icebox (no CPR if signs of life)
  ◆ Metabolic icebox: prolonged CPR if really needed
  ◆ Difference between hypothermia and cold-water submersion
Management:
- Exertion
- Head-up position
- Rehydration
- Afterdrop
- Rewarming shock: warm fluids
- Can’t add too much heat in field, but add to core
- How to add heat?
  ◦ Insulation
  ◦ Warm person?
  ◦ Water bottles as heat packs
  ◦ Real heat packs
  ◦ Warm IV
  ◦ Warm, humidified oxygen
  ◦ HeatPAC charcoal vest

BCLS and ACLS for hypothermia patients:
- BCLS:
  ◦ Ventricular fibrillation risk vs temperature?
  ◦ Vent rate?
  ◦ CPR rate?
  ◦ Pauses?
- ACLS:
  ◦ Intubation?
  ◦ Not causing ventricular fibrillation?
  ◦ Atrial fibrillation: normal
Defibrillation: not until 86°C
Drugs: no!
Except: bretylium
Triage to bypass rewarming center?

Altitude

AMS/HACE:
- Rapid ascent, living at low altitude: feel like hung over. HA, nausea. If ataxia or AMS is HACE.
- Prevention: acetazolamide 125 BID, dexamethasone 4 mg BID (more if rushing), Gingko? Naah.
- Treatment: descend 1000' (300m), Gamow bag, oxygen, acetazolamide 250 BID, dexamethasone 8mg STAT and then 4 mg QID.

HAPE
- Rapid ascent, living at low altitude. Can’t treat like CHF, is different.
- Prevention: Nifedipine-SR 60 PO daily, salmeterol a bit, ?? Cialis ?? need more studies
- Treatment: oxygen ? with CPAP, Gamow bags, NO DIURETICS, nifedipine

Diving:
Gas Laws (think little ping-pong balls)
- Boyle’s Law: Volume varies inversely with Pressure
- Dalton's Law: partial pressures
- Henry's Law: why the coke fizzes when you pop the top

**Barotrauma: sinus squeeze, TM perfs > vertigo, etc.**

**Decompression Illness (DCI)**
- Arterial Gas Embolism from expanding air in lungs: Left side, head down, trap air in the heart, prevent stroke
- Decompression Sickness ("The Bends"): small bubbles, anywhere in the body, in first 24 hours: OXYGEN to flush out inert gases. HBO (AGH or Presby, not Mercy); what about air transport?

**Near-Drowning**
- Distress vs. drowning silently
- Red Cross flip for lifesaving: c-spine
- Diuresis from hydrostatic squeeze and mammalian diving reflex: cardiovascular collapse on removal
- Need for flotation for medics/units: Class 5 vests in both my cars with polypro throw lines in bags
- Assume hypothermic, acidotic, hypoxic
- Mammalian Diving Reflex from cold water on face (bradycardia, vasoconstriction, blood moves centrally)
- Cold shock (dominates over mammalian diving reflex): gasp,
hyperventilation, hard to swim
(Giesbrecht’s “1 min, 10 min, 1 hour”)

- Laryngospasm
- Fresh water in lungs: dilution of blood and hemolysis
- Fluid-filled (salt water) or atelectatic (fresh water) alveoli: intrapulmonary shunt, secondary drowning (transudate, protein-rich fluid): up to 12 hours later, so transport, and ED should observe in obs unit or admit.
- Hypothermia may be protective (cf brain cooling for cardiac arrest)
- Delayed problems (up to 3 days later: renal failure)

Treatment:
- Oxygen
- CPAP
- No Heimlich
- Pulse check x 1 minute and other management as for hypothermic patients