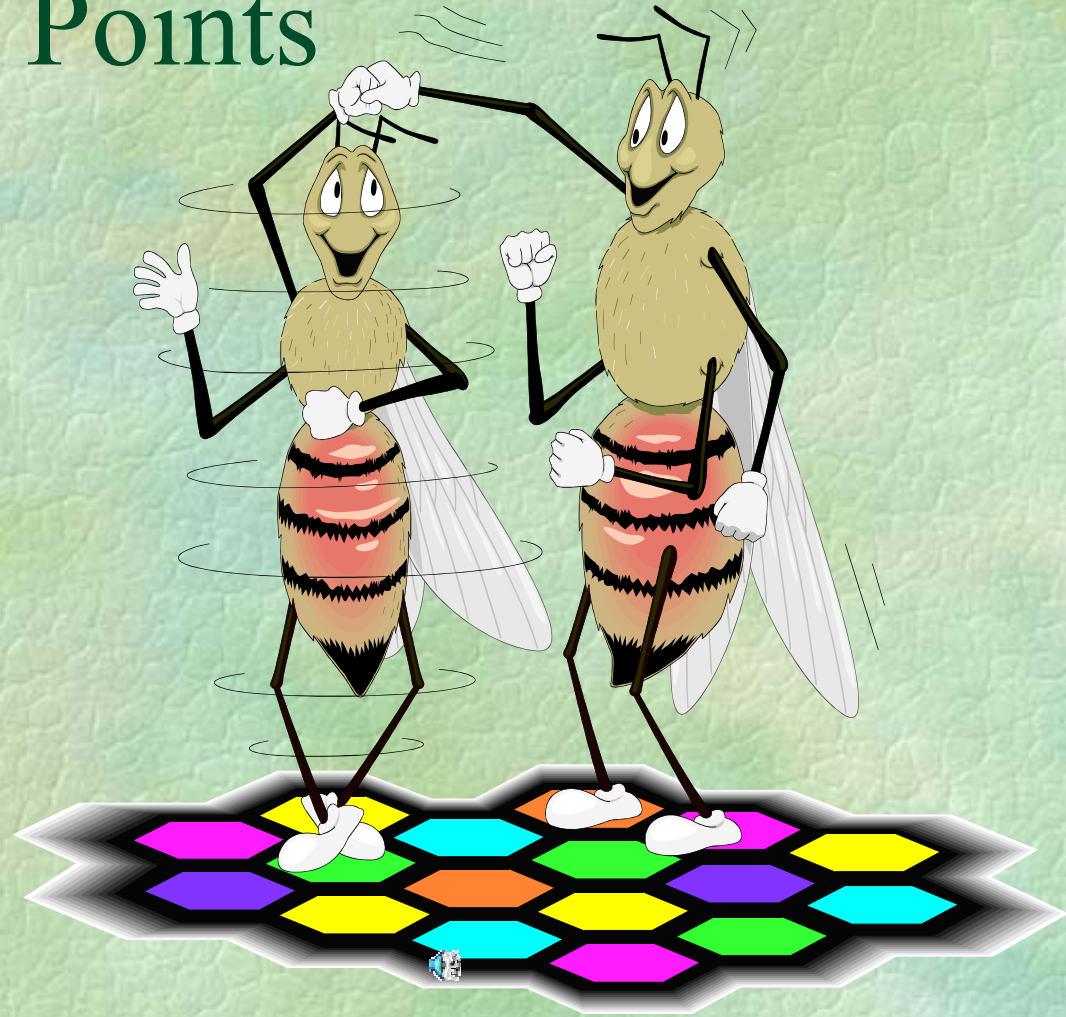


Environmental Emergencies

Quick & Dirty Points

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Six Main Areas

- ☛ 1. Diving Emergencies / Dysbarism
- ☛ 2. Electrical Injury
- ☛ 3. High Altitude Illness
- ☛ 4. Radiation Injury
- ☛ 5. Bites and Stings
- ☛ 6. Hot and Cold Injuries

SCUBA Diving: Good clean fun!



Diving Emergencies / Dysbarism

- ☞ Boyle's Law: pressure and volume are inversely related
- ☞ Descent: high pressure=low volume: cavities get squeezed
 - barotitis externa: cerumen traps air in EAC
 - middle ear squeeze: classic triad=Meniere's : tinnitus, deafness, vertigo
 - sinus squeeze

What is the problem here 100 feet under-something went wrong?



Diving Emergencies / Dysbarism

☛ Descent: Nitrogen Narcosis = “Rapture of the Deep”

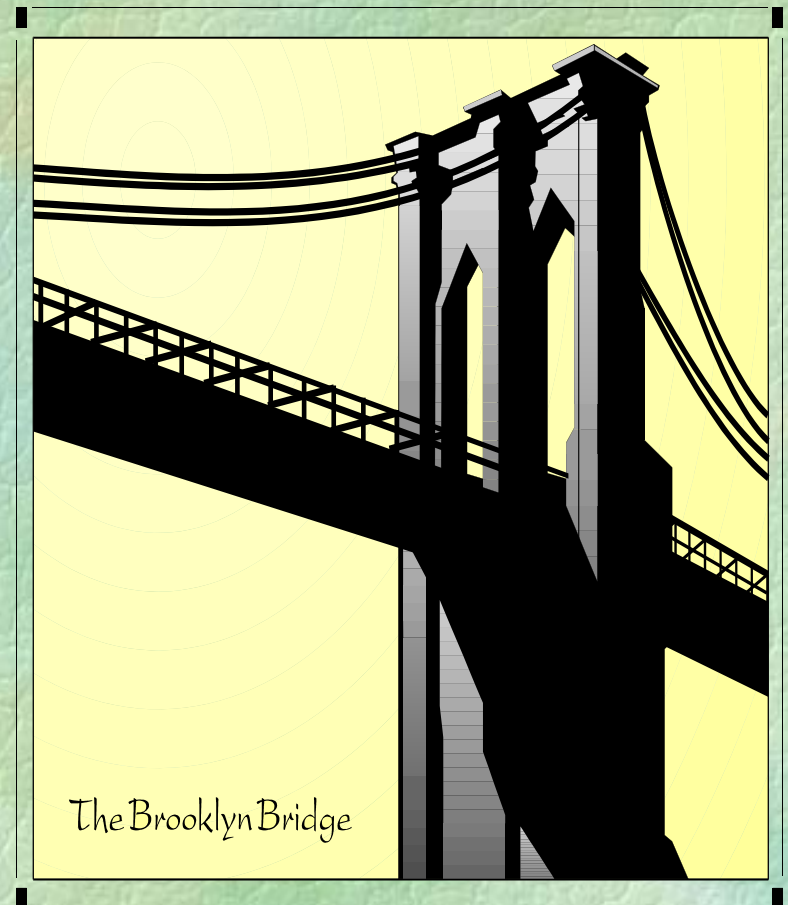
- partial pressure of nitrogen increases
- nitrogen has anesthetic properties
- euphoria - judgement loss - hallucinations then ultimately severe confusion and drowning
- begins at 100 feet below water = how many atmospheres is this?

Diving Emergencies / Dysbarism

- ☛ Ascent: the top 33 feet are the most dangerous!!!! 1 atm pressure=33 feet
- ☛ POPS= pulmonary overpressure syndrome: lung rupture due to expanding trapped gas; pneumothorax/mediastinum +/- tension
- ☛ CHOKES=emboli of gas to pulmonary vessels: pleuritic pain, cough, dyspnea
- ☛ Skin: ruptured skin blood vessels=purpura marmorata

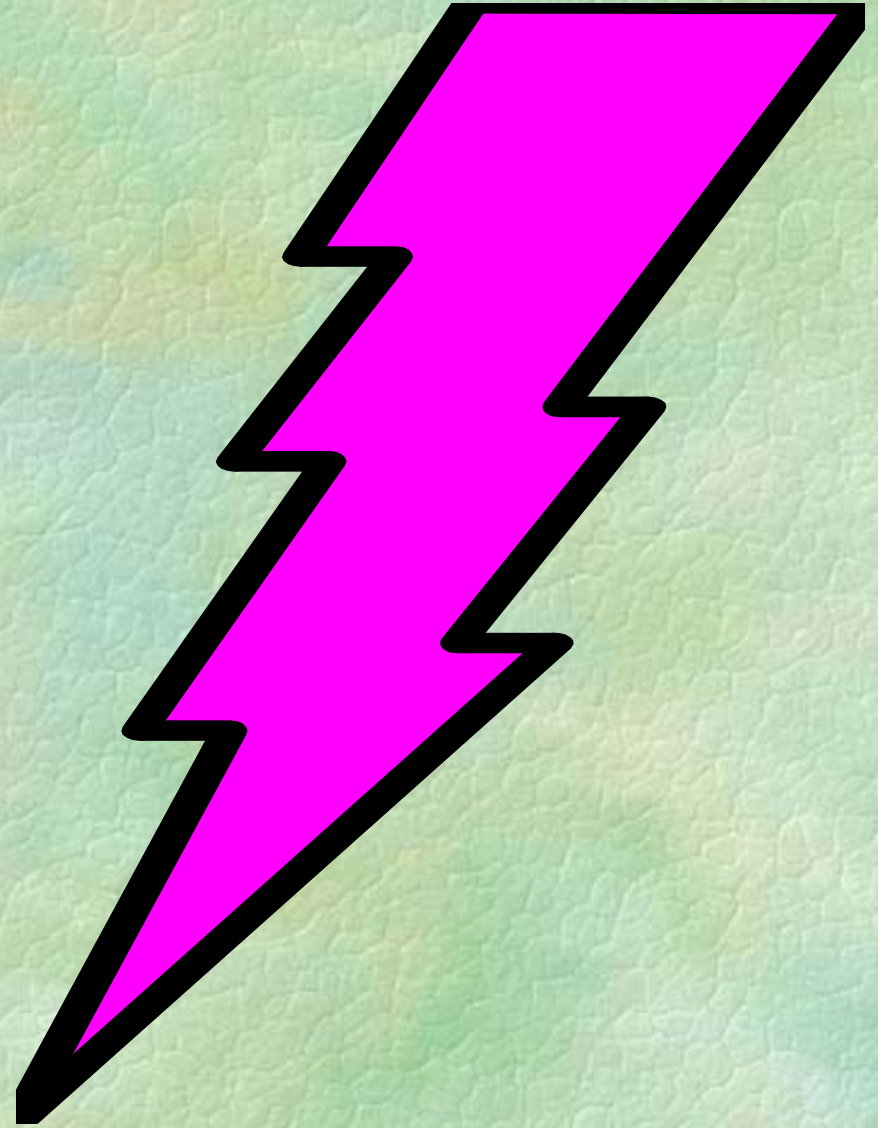
Diving Emergencies / Dysbarism

- Ascent: BENDS or Caisson's Disease= bubbles in joints
- LETHAL Volume of venous air= 100-150cc
- MOST COMMON & Dangerous site of arterial gas embolism = cerebrum: stroke / seizure; spinal cord: paralysis: delta MS presentation within 10 minutes of a too rapid ascent
- RX: HBO (also for $CO_2 > 25$ (NYC))



Electrical Injury


- ☞ Current (AMPS) is more important than Voltage
- ☞ AC is worse than DC
- ☞ AC entrance wound = exit wound
- ☞ DC entrance wound < exit wound (like a bullet)
- ☞ Oral commissure burns (#1-PEDS) = +/-ADMIT due to delayed labial artery bleeding



Electrical Injury

- ☛ Electrical energy is converted to HEAT
- ☛ Increased tissue resistance = + or - heat?
- ☛ Tissue conduction: nerve > blood > tissue & muscle > fat > bone
- ☛ Household electrical current = AC 60 c/s
- ☛ “Let go current” = 20-30 mAmp
- ☛ Which current has the greatest risk of inducing V. Fib ? AC or DC ?

What voltage exposure is an automatic ADMIT?

? Ie 3rd Rail

What voltage exposure is an automatic ADMIT?

 >600 Volts

Electrical Injury

- ☛ Electrical injury with some current (220V) through the chest: can the patient go home?
- ☛ IF THE ECG IS NORMAL INITIALLY AND AFTER A 3-6 HR ED MONITORING PERIOD = DISCHARGE HOME

Lightning Injury

- ☛ Massive DC electrical shock
- ☛ 30% mortality
- ☛ Cataracts
- ☛ Ruptured TM's (Blast component)
- ☛ Motor Paralysis: pupils unreliable, diaphragm dysfunction, hypoxia, myoglobinuria
- ☛ Skin: flash arborescent burns

Lichtenberg Figures Due to a Lightning Strike



Lightning Injury

☛ What if a patient in a disaster setting is in **ASYSTOLE** due to a lightning strike?

Blast Injuries: ie from Lightning

- ☛ Type I: pulse of pressure-barotrauma: TM rupture is #1, pneumothorax=most serious, air embolism(rare)
- ☛ Type II: flying debris: penetrating trauma
- ☛ Type III: flying human: deceleration impact
- ☛ Type IV: toxic gases ie hydrogen sulfide= knock down gas, radiation, burns

High Altitude Illness

- ☞ As the altitude increases the pressure decreases & PO₂ decreases
- ☞ Temperature decreases 6.5 deg C/1000m & DRY
- ☞ UV penetration increases 4%/300m: Keratitis
- ☞ Ventilation increases:
Hypoxic Ventilatory Response: resp alkalosis w/HCO₃ excretion=bicarb diuresis & dehydration



High Altitude Illness

☞ How does UV keratitis look after fluorescein application on slit lamp?

High Altitude Illness

- ☛ Increased erythropoietin within 2 hrs
- ☛ Hct increases 5% over 20 days
- ☛ Bicarbonate diuresis + increased Hct = polycythemia (lasix can be lethal in HAPE)
- ☛ Hypoxia: increases 2,3 DPG & Hb O₂ dissociation right shift
- ☛ Sleep is disturbed
- ☛ PaO₂ = 33 torr at 8840meter (Mt. Everest)

High Altitude Illness

☞ SYNDROMES: Due to too rapid ascent

- Acute Mountain Sickness: SX >2000 meters: N/V, “flu”, decreased hypoxic ventilatory response: RX: What drug 24-48 hrs before ascent may lessen SX?
- HAPE=pulmonary edema: low partial pressure of O₂ leads to pulmonary overperfusion & hydrostatic leakage of fluid in alveoli
- RX:O₂, RAPID DESCENT #1, nifedipine may have a role to decrease the pulmonary HTN, NO STEROIDS

High Altitude Illness

☞ HACE: cerebral edema: due to increased cerebral blood flow due to a reflex response to the reduced O₂ saturation

- SX: HA, delta MS, N/V, ataxia, seizures, cranial nerve palsies (6th), 50%-papilledema
- RX: O₂, STEROIDS (dexamethasone), RAPID DESCENT, possible mannitol, if no gag
GCS=8=tube and hyperventilate PCO₂=30-33,
HBO

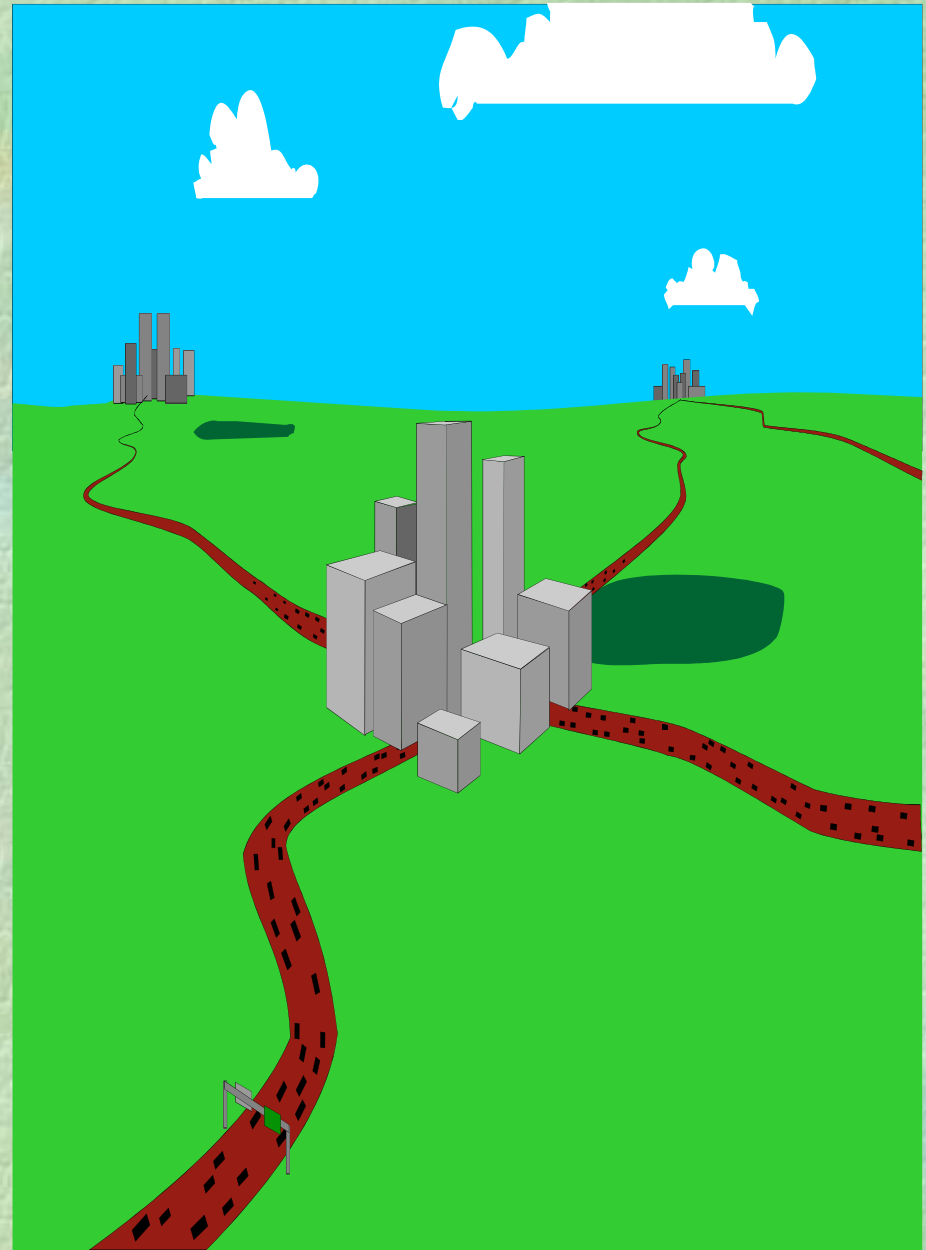
Radiation Injury

☛ One Gray = 100 Rads

☛ Penetration

- alpha = superficial
- beta = 8mm penetration
- gamma = deep penetration & acute radiation poisoning

☛ MEDIAN LETHAL DOSE = 450 RADS



Radiation Injury

- ☛ EARLY SYMPTOMS INDICATE A HIGHER DOSE AND WORSE PROGNOSIS
- ☛ Survival probable: <200 Rads
- ☛ GI SX: N/V/D = >100 Rads exposure
- ☛ Neuro SX: BAD = >800 Rads = death

Radiation Injury

☛ Lymphocytes are most sensitive to radiation and the lymphocyte count at 48 hrs is a prognosis marker

- >1200 = very good prognosis
- 300-1200 = possibly lethal exposure
- < 300 = certain death

Radiation Injury

- ☛ RX: ABC's, determine exposure type & dose
- ☛ Decontaminate on scene
- ☛ Soap & water including hair w/ vigorous scrubbing = 95% decontamination
- ☛ MOST PATIENTS WHO DIE FROM RADIATION INJURY, EXCEPT IN HIGH DOSE CRITICAL CASES, DIE OF ?

Bites and Stings: clockwise from the top right portion of the figure are a yellow jacket, honeybee, bumblebee, Polistes wasp, and two hornets



Bites & Stings

- ☞ #1 KILLER ?
- ☞ Hymenoptera: Bees, Wasps, Ants, Hornets
- ☞ Toxic rxn: >10 stings, presensitization = anaphylaxis (epi, benadryl, steroids, tagamet); SHOCK= 1:10, 000, 0.1mg IV epi
- ☞ Delayed Rxn: 2 wks later serum sickness
- ☞ Stings around the eye: catatracts, glaucoma
- ☞ Remove stinger by SCRAPING OFF

What is the diagnosis?



Yellow Jackets



Bites & Stings

☛ TICKS

- RMSF: Dermacentor Andersoni, rash, HA
- Q Fever: influenza like illness
- Tularemia: rabbits
- Tick Paralysis: Killer; RX=remove the tick
- Babesiosis: protozoan/ splenomegaly
- Lyme disease: Ixodes tick-spirochete
- Boreliosis: HA, relapsing fever
- Ehrlichiosis: rickettsial, mono & granulocytic

What is the Diagnosis?



What is the Diagnosis?



What is the Diagnosis?



Brown Recluse Spider

☛ Brown Recluse Spider: dark violin top, **delayed pain**, ischemic necrosis, hemolysis; RX: no ice, dapsone, HBO, surgery, no antivenin

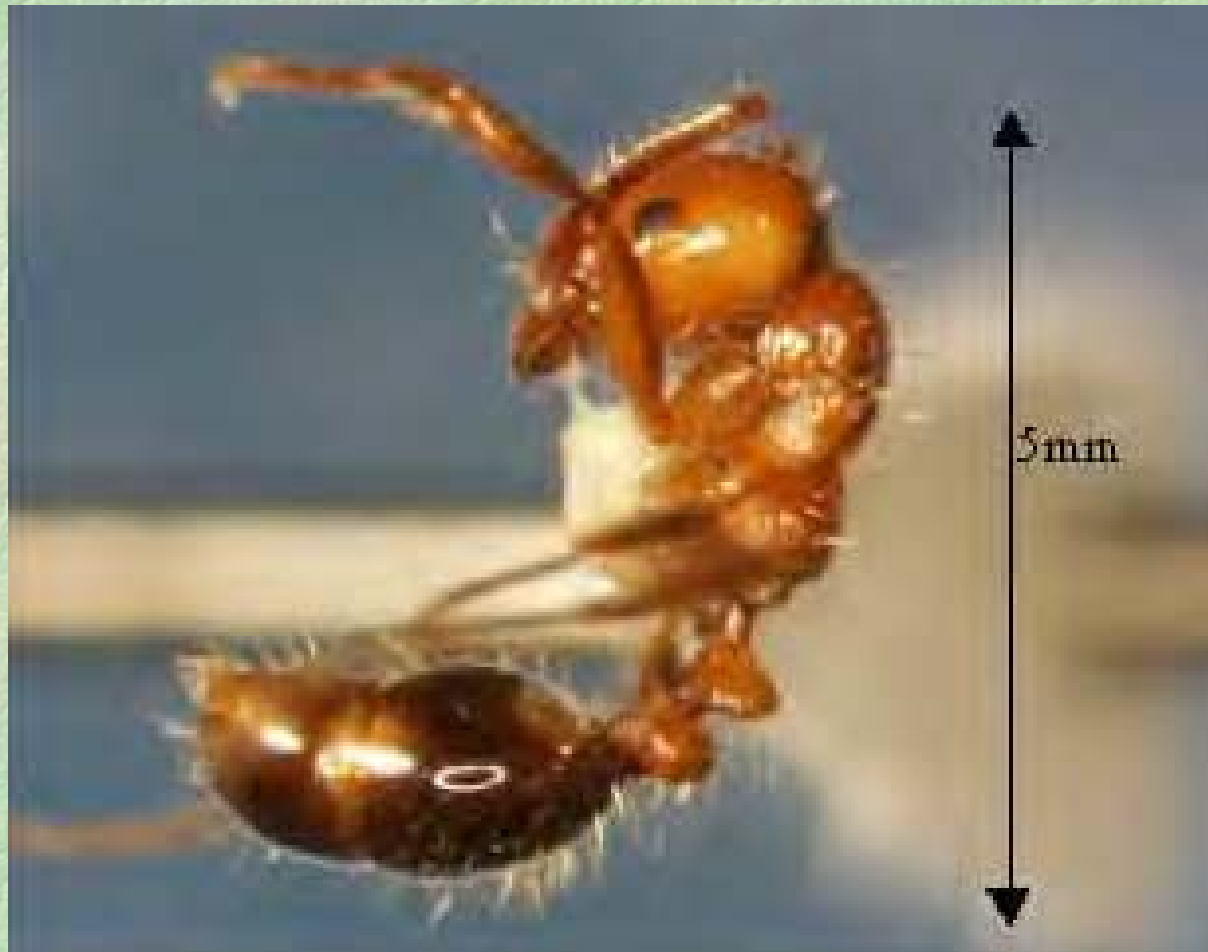


Black Widow Spider

☛ Black Widow Spider:
red hourglass bottom,
two small puncture
marks, **immediate
pain**, N/V/cramps
mimics appendicitis;
RX: ice, calcium
gluconate, anti-venin
if neuro Sx, HTN, or
severe pain



Fire Ants



**FIRE
ANTS
MUST
DIE!**



What if you picked up this snakes cut off head after it was shot 30 minutes ago?



Bites & Stings

- ☛ Crotalidae: = rattlesnakes, moccasins, copperheads; hemotoxic & neurotoxic, coagulopathy, DIC. How to ID?: bilat pits, triangle shaped head, single row of anal plates
- ☛ mild: swelling, erythema
- ☛ mod: N/V, tachy, mild hypotension
- ☛ severe: DIC (prol. PT, PTT, low platelets & fibrinogen), delta MS, hypotension, compartment syndrome risk
- ☛ RX: antivenin for mod-severe (10vials): New RX: CROFAB (both anti-neuro & anti-hemo toxins!)

Which one would you want to bite you?
Hint: ICU (delayed respiratory paralysis)
vs. Go Home



Bites & Stings: Coral Snake

- ☞ Elapidae: = Coral, cobra; severe neurotoxins
- ☞ **BIG PROBLEM IS DELAYED AIRWAY PARALYSIS = ICU ADMIT**
- ☞ **HOW TO ID A CORAL SNAKE VS THE NON-POISONOUS KING SNAKE?**

Australian Brown Snake



MARINE: Bites & Stings

- ☛ Puffer fish:
- ☛ Tetrodotoxin
- ☛ ascending paralysis
- ☛ FUGU chef



Man put his hand in a fish tank and was stung by this fish; Rx: ?

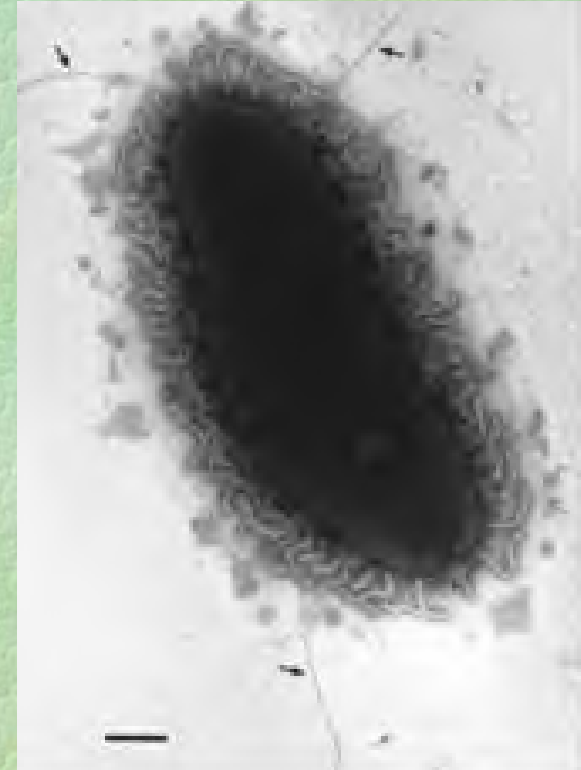
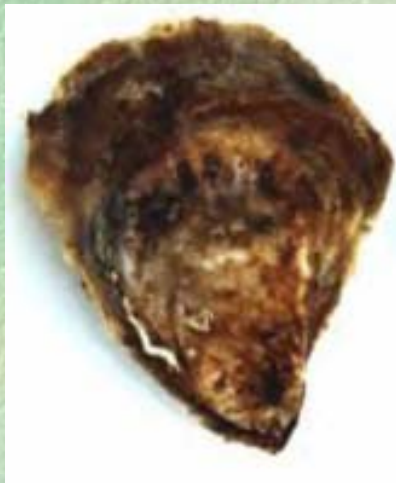


Which is the most lethal oyster for a liver cirrhosis patient?



Warm water raw oysters: Gulf of Mexico, a good idea?

- ☞ Raw oysters w/ *Vibrio vulnificus* especially in a patient with liver disease or immunocompromise = lethal cellulitis and sepsis: **MUST COVER WITH DOXYCYCLINE**



This is the last thing you want looking at
you while swimming the coral reef!!

What is it?



Stone fish = life threatening; RX: antivenin



Hypothermia Case

- ☞ 29 y/o woman under the ice in Norway for 79 minutes
- ☞ EMS arrive & patient is clinically dead in asystole with a temp of 14.4C
- ☞ WHAT TO DO NEXT?

Key Temperature: 30C / 86F

- ☛ Triggers active core rewarming
- ☛ Lose shivering mechanism
- ☛ J-waves on ECG
- ☛ Increased Risk of dysrhythmias

What is the diagnosis?



Chilblains / Pernio: itchy & tender



Frostbite: what should be done with these blisters?



What temperature do you start cooking yourself?



107.5 F

You start denaturing your
proteins at this
temperature!

RX: cool patient STAT