Modernizing our Specimen Preparation Safety Procedures in a Risky World

Safety and Cultural Heritage Summer
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What is the risk to Specimen Preparators….?

- Zoonotic diseases
  - Understanding the lifecycle and habitat range of both your specimens and zoonotic diseases
  - Specimen must first be infected itself before it can infect you
  - Infection risk/severity versus infection probability
- Venomous or toxic specimens
  - Reptiles and several species of *Anura* remain venomous/toxic after death
  - Proper handling procedures must be taken
- Proper Sharps and dissection training for anyone participating in a preparation lab
  - Choosing proper PPE and following basic laboratory safety standards

Field and laboratory exposure risks are generally mild or moderate….

….But it only takes one infected specimen

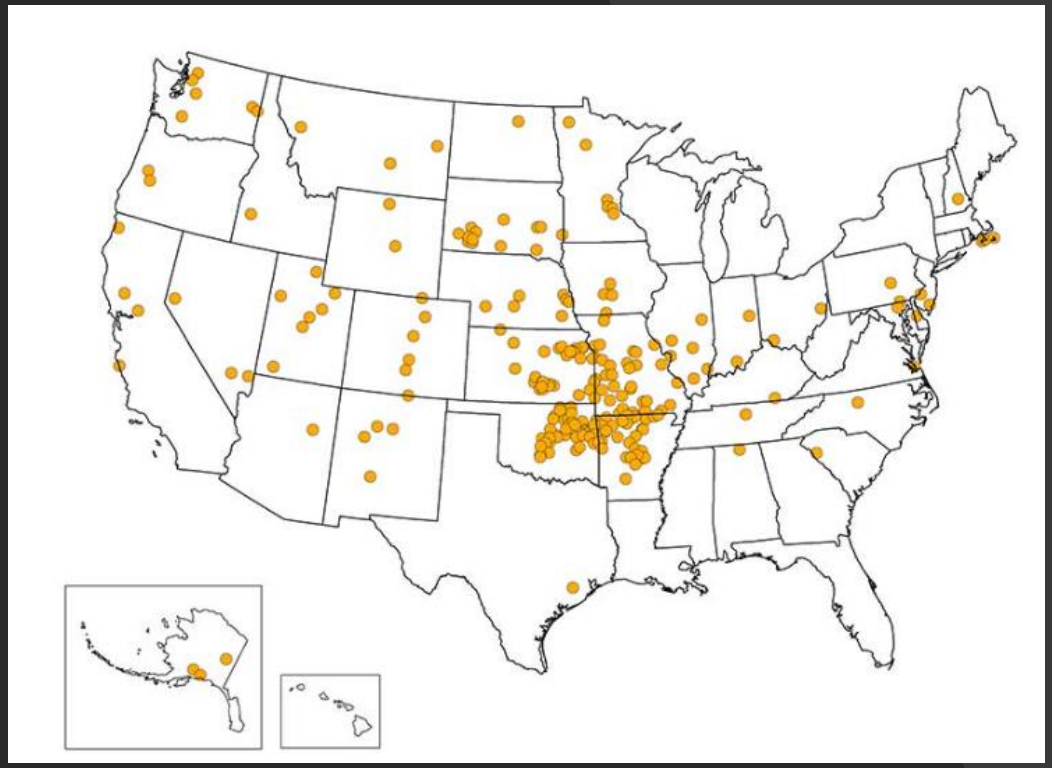
Rabies lyssavirus

Close-up of a dog's face during late-stage "dumb" paralytic rabies. Source: Public Health Image Library ID# 2614

- Remains viable in any moist tissue, and can replicate in muscle tissue
- Remains viable in freezing temperatures; only denatured by sunlight or desiccation
- Specimens are not routinely tested for the virus
- Booster doses required between every 6 months to 2 years
- Exposure Risk:
    - Significant laboratory exposure risk **and** probability
    - 1950-1980, 97% of exposures caused by bites; 1.2% occurred from laboratory exposure
    - 2017: 4,055 wildlife-related rabies cases reported to the CDC.

Tularemia (Ulceroglandular tularemia)

- Caused by the bacterium *Francisella tularensis*
- Moderate field and laboratory probability
- Extremely contagious and widespread
- Survives for weeks after death or in infected soil
- Especially prevalent in rodents, lagomorphs, but is also known to be carried by birds, sheep, dogs, and cats
- Exposure occurs through several routes, including the handling of an infected animal or carcass, or the handling of infected dirt or dust.



Map of reported human cases of Tularemia in 2017. One dot placed randomly within county of residence for each reported case (n=239). Source: Center for Disease Control and Prevention: Tularemia Statistics

(Some) Other North American Zoonotic Diseases

The anterior thoracoabdominal region of a Plague-infected rock squirrel, *Spermophilus variegatus*, showing a petechial rash. Source: Public Health Information Library, ID #6720

- Yersinia Pestis (Septicemic Plague)
  - Moderate field probability; Moderate laboratory probability
  - Occurs from improper handling of an infected specimen
  - An average of 7 human cases are reported each year; 80% are bubonic plague
  - Western U.S. is known to have high levels of plague among rodent populations
  - Eric York, 2007
- Echinococcus
  - Mild field probability
  - Parasitic infection of two *Echinococcus* tapeworm genera
  - Present in cervids, canines, raccoons, etc.;
  - Exposure by handling infected specimens without PPE
- Psittacosis
  - Mild field probability
  - Bacterial infection caused by Chlamydophila psittaci
  - Spread by multiple bird species ; Exposure through infected droppings
- Hantaviruses
  - Moderate field probability; mild laboratory probability
  - 2017 outbreak of Seoul Virus
  - Rodents are the natural reservoir for hantavirus
  - Exposure occurs from infected urine, feces, saliva, bedding/dust, or direct bite

So how do we mitigate these risks…?

- Educate your people
  - All laboratory and field workers or volunteers need to be aware of disease potentials
    - They should also have serious conversations with their primary care physicians
  - Need specific PPE depending on each species and where they were caught
  - Need to take Sharps training seriously
    - Must report any accidents immediately – even ones that do not seem serious
  - Might need to work in specific environments, such as fume hoods, or designated lab spaces
  - Should have a good working relationship with OSHA in case of exposure

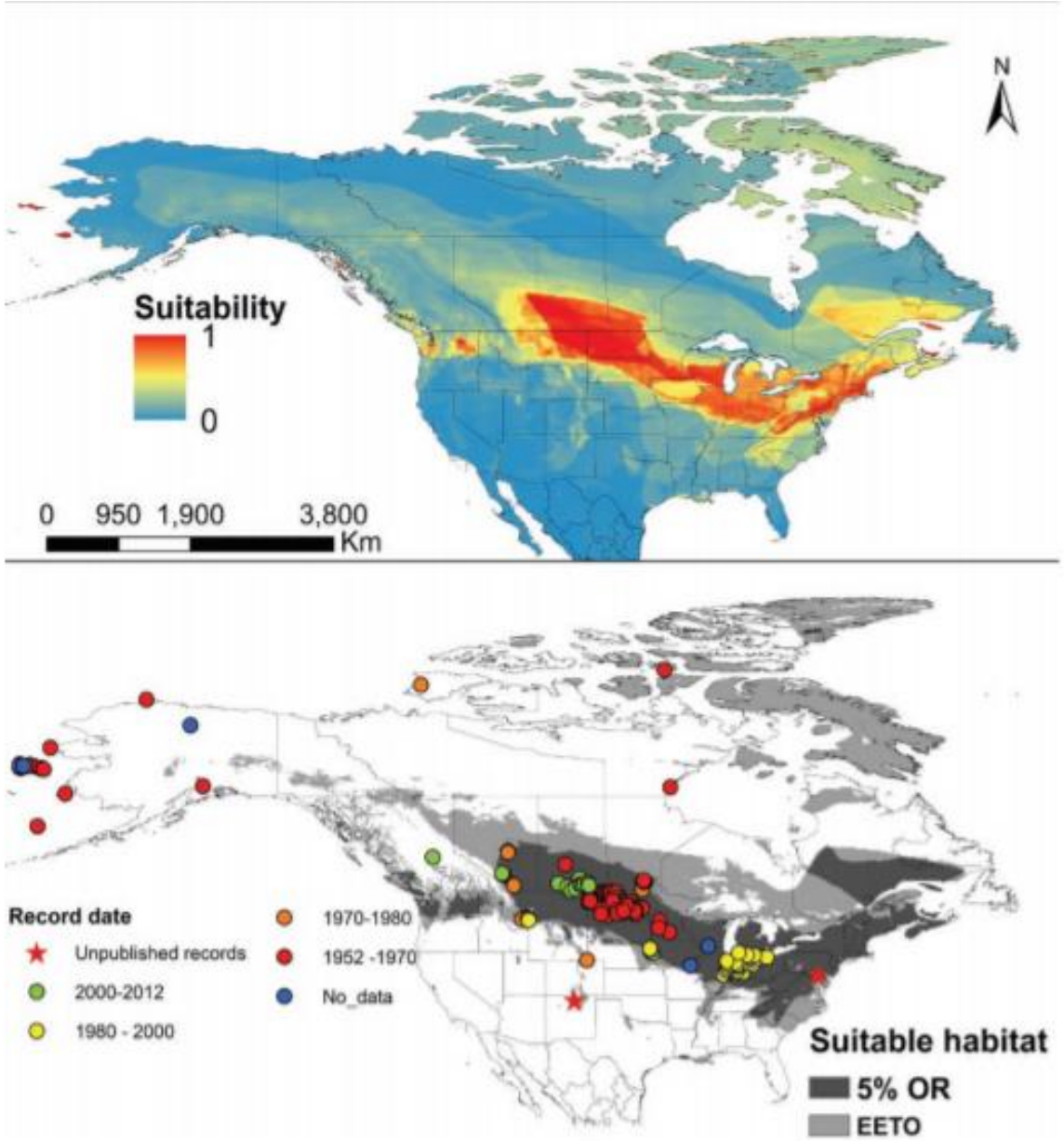
- You should have a good working relationship with OSHA in case of exposure

- Write down **and** review your procedures!

- Be aware of the effects of climate change!

Speaking of climate change…

Results of the Maxent distribution model of Echinococcus multilocularis. A) Median continuous environmental suitability index on a log scale resulting from the 50 replicas; warmer colors indicating higher suitability. B) Binary prediction of suitable environmental conditions using two different reclassification thresholds. The dark gray distribution represents the threshold that keeps 95 % of the records, while the light gray area represents the suitable area using a threshold that equates entropy of threshold and original distributions. Occurrence location data used in the model are displayed by date of collection.



Source: Botero-Cañola, Sebastian et al. The ecological niche of Echinococcus multilocularis in North America: understanding biotic and abiotic determinants of parasite distribution with new records in New Mexico and Maryland, United States. THERYA, 2019, Vol. 10 (2): 91-102 .

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