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- Overview of Rabies
- Why should we be concerned?
- Clinical Signs in Animals
- How do we respond?
- Testing of Animals
- Other Important Zoonotic Diseases

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Overview of Rabies



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What is Rabies?

- Viral Infection
- Causes an incurable encephalitis
 - Encephalitis is inflammation of the brain
 - Essentially 100% fatal once clinical signs are noted
- ★ Extremely rare to survive
- Post-Exposure prophylaxis (rPEP) administered before the onset of clinical signs generally curative (in humans)



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What is Rabies?, *cont.*

- Transmitted through direct contact with saliva or nervous tissue from an infected animal
 - In the US - cases are generally caused by exposure to wildlife
 - Outside the US – most cases are associated with exposure to dogs



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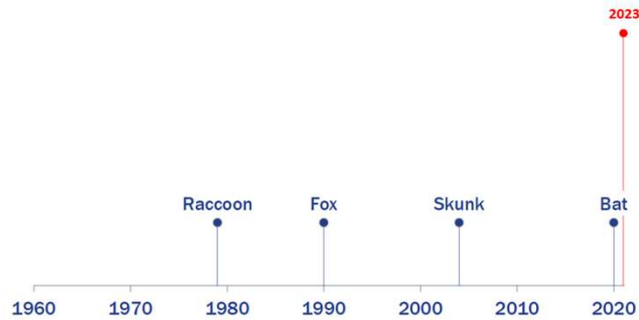
What is Rabies?, *cont.*

- All mammals are susceptible to rabies
- Only a few species are important reservoirs for infection
- Small Prey animals do NOT typically carry rabies



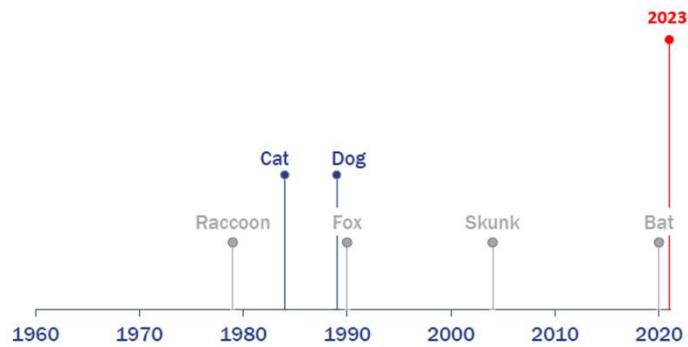
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Rabies in Indiana



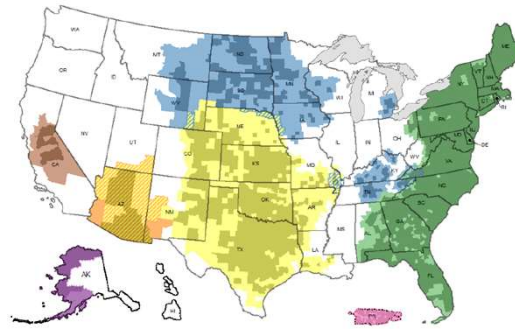
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Rabies in Indiana, *cont.*



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Terrestrial Reservoirs Species in the US



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Why should we be concerned?



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Prevalence of Rabies in Humans

	United States
Number of Cases	
Annual	1 - 3
2009 - 2018	25
2019 - 2020	0
2021	5
Risk Factors	
Age < 15 years	2 (8%)
International Travel	7 (28%)
Animal exposure	Bat (70%)

Credit Dr. Jennifer Brown ISDH

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Prevalence of Rabies in Humans, *cont.*

	United States
Number of Cases	
Annual	1 - 3
2009 - 2018	25
2019 - 2020	0
2021	5
Risk Factors	
Age < 15 years	2 (8%)
International Travel	7 (28%)

In 2021, there were 5 human deaths in the United States due to rabies.

- Two people did not realize they had been exposed.
- Three people knew they were exposed but chose not to receive rPEP!!

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Prevalence of Rabies in Humans

	United States	Worldwide
Number of Cases		
Annual	1 - 3	Est 59,000
2009 - 2018	25	
2019 - 2020	0	
2021	5	
Risk Factors		
Age < 15 years	2 (8%)	~236,000 (40%)
International Travel	7 (28%)	Unknown
Animal exposure	Bat (70%)	Dog (99%)

Credit Dr. Jennifer Brown ISDH

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Elimination of canine variant rabies from the U.S.

- Successful vaccination of pets
 - Not all states in the U.S. require vaccination of dogs, cats, and ferrets
 - ★ • Indiana *does* require vaccination of dogs, cats, and ferrets
- Animal Control Programs
- Public health surveillance and testing
- Availability of rabies post-exposure prophylaxis (rPEP)



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NOT a disease of the past!

- Shift in veterinary medicine toward the reduction of vaccines
- Dogs are being imported into the United States on a regular basis
- Animals that are "inside only" are not exempt from exposure to bats

We MUST remain vigilant in the identification, diagnosis and prevention of Rabies.



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2021 Rabies Cases

- June 2021, 33 dogs and one cat imported into the US from Azerbaijan via O'Hare International Airport
- Animals immediately dispersed to foster homes and rescue facilities
 - Pennsylvania
 - Illinois
 - New Jersey
 - New York



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2021 Rabies Cases, *cont.*

- Dog in Pennsylvania developed clinical signs, was euthanized and found to be positive for rabies
- 12 humans were exposed and received rPEP treatment
- **This was the 4th incident of rabies associated with the importation of a rescued animal since 2015.**



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Capital Hill Fox

- April 2022 – A wild fox exhibiting unusual behavior on Capital Hill
- Unprovoked bite of at least 9 people
- Captured and found to be positive for Rabies virus
- All exposed individuals were treated with rPEP



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Clinical Signs in Animals



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Prodromal Phase

- Lethargy
- Fever
- Vomiting
- Anorexia
- Minor behavioral changes



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★ Furious Form

- Aggression
- Erratic behavior
- Restless and irritable
- Sensitive to visual and auditory stimuli
- Seizures



Photo Credit – CDC Public Health Image Library #8319

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★ Dumb Form

- Ataxia
- Weakness
- Paralysis
- Difficulty breathing
- Difficulty swallowing
- Excessive salivation



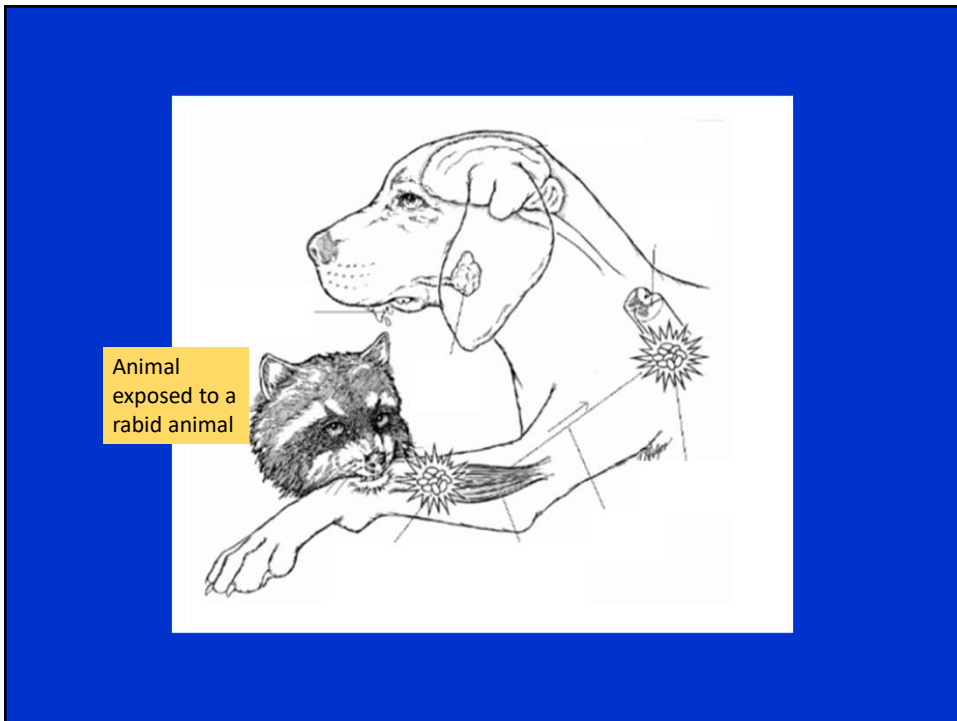
Photo Credit – CDC Public Health Image Library #17330

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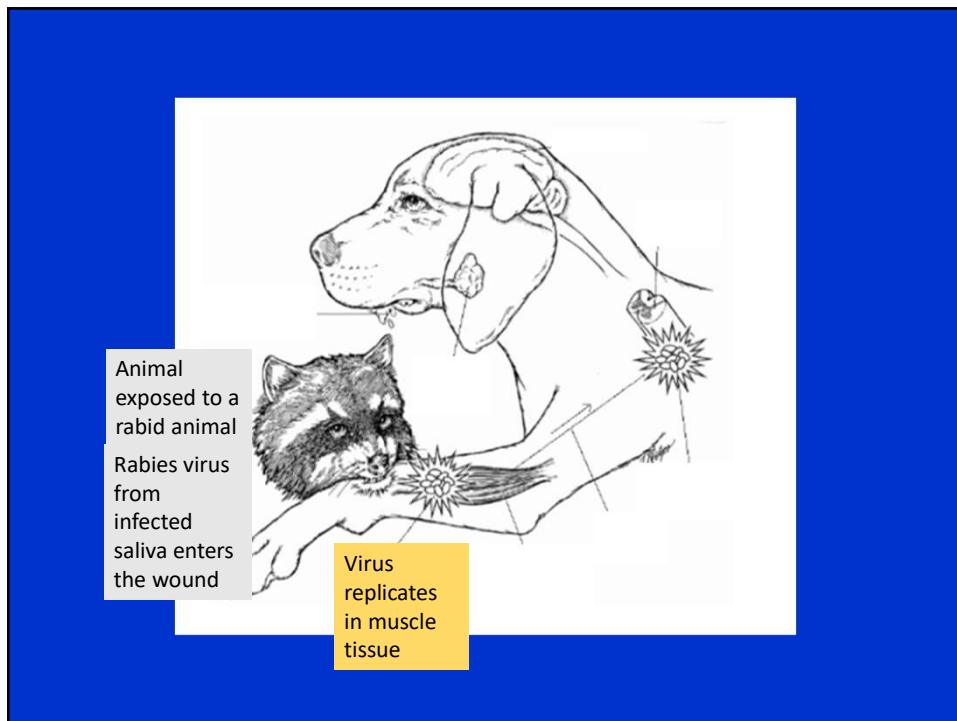
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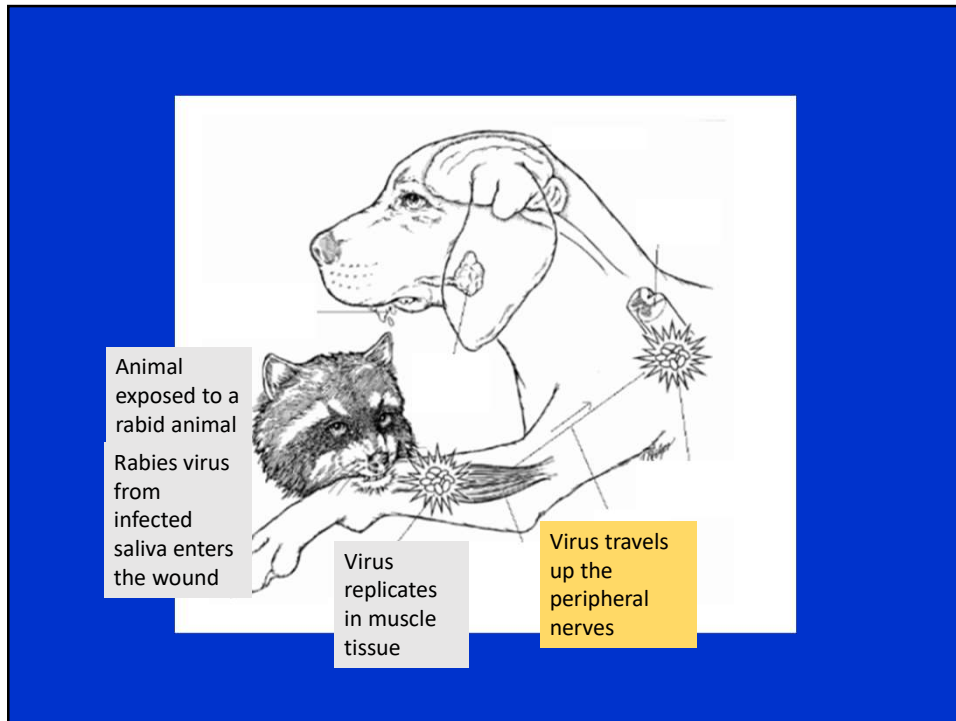
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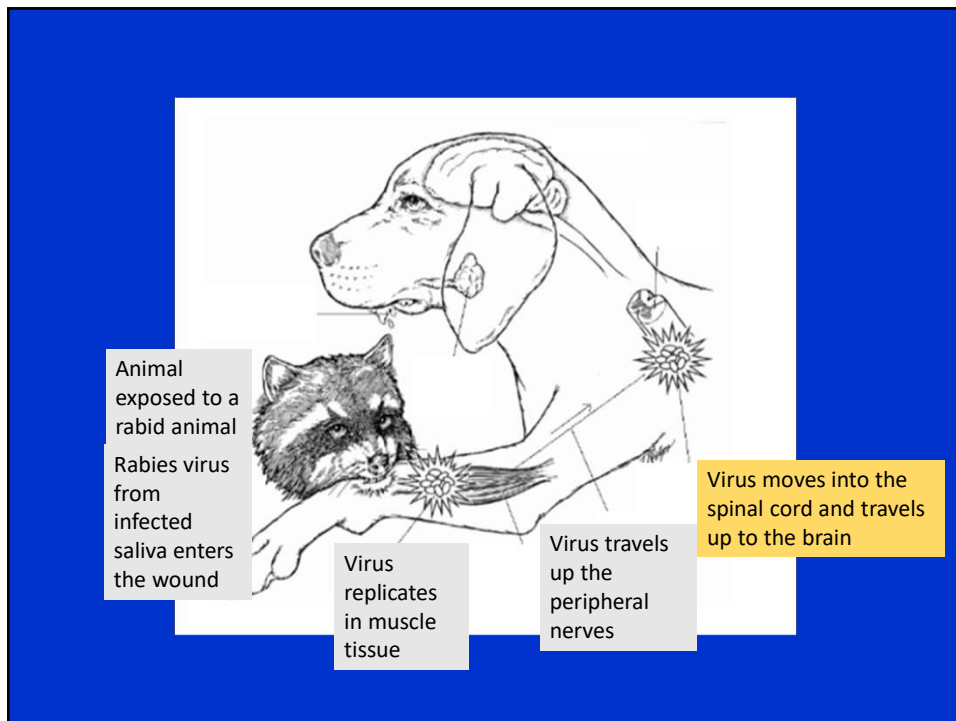
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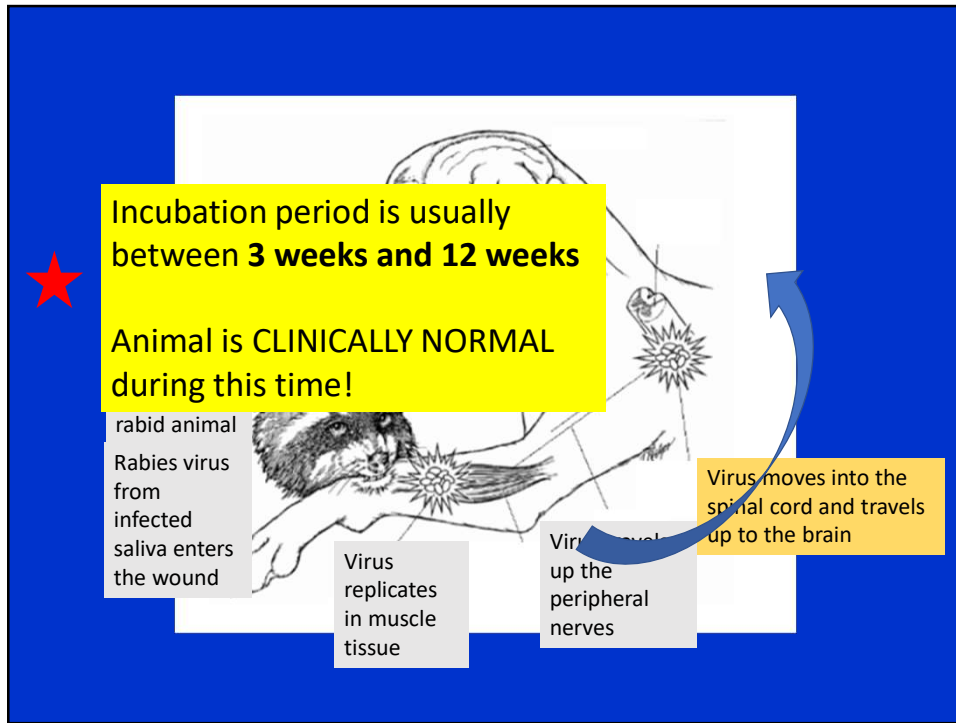
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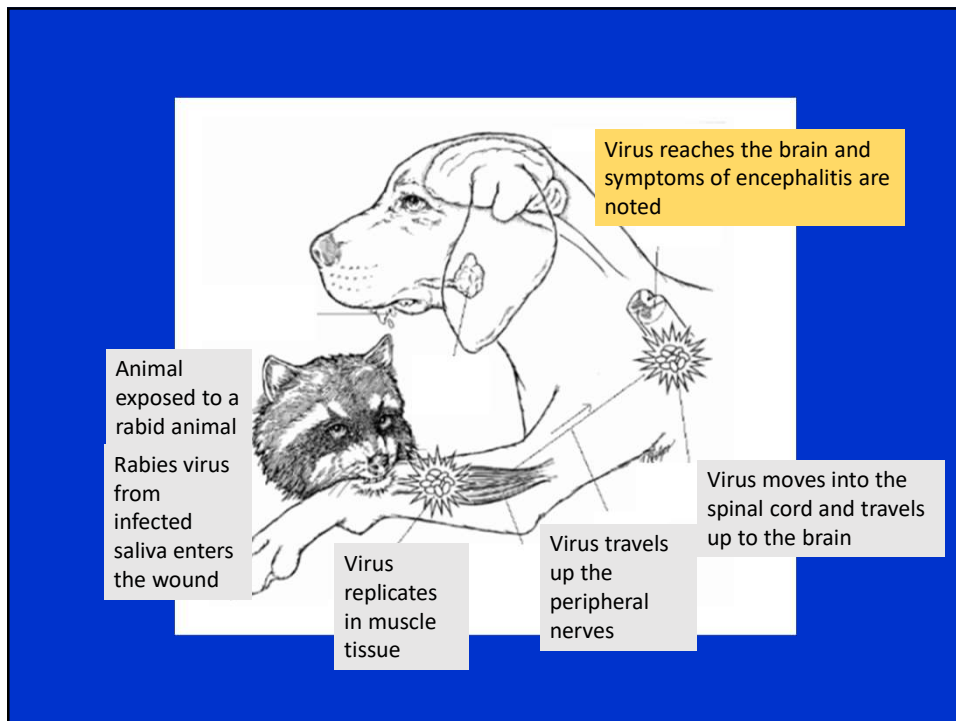
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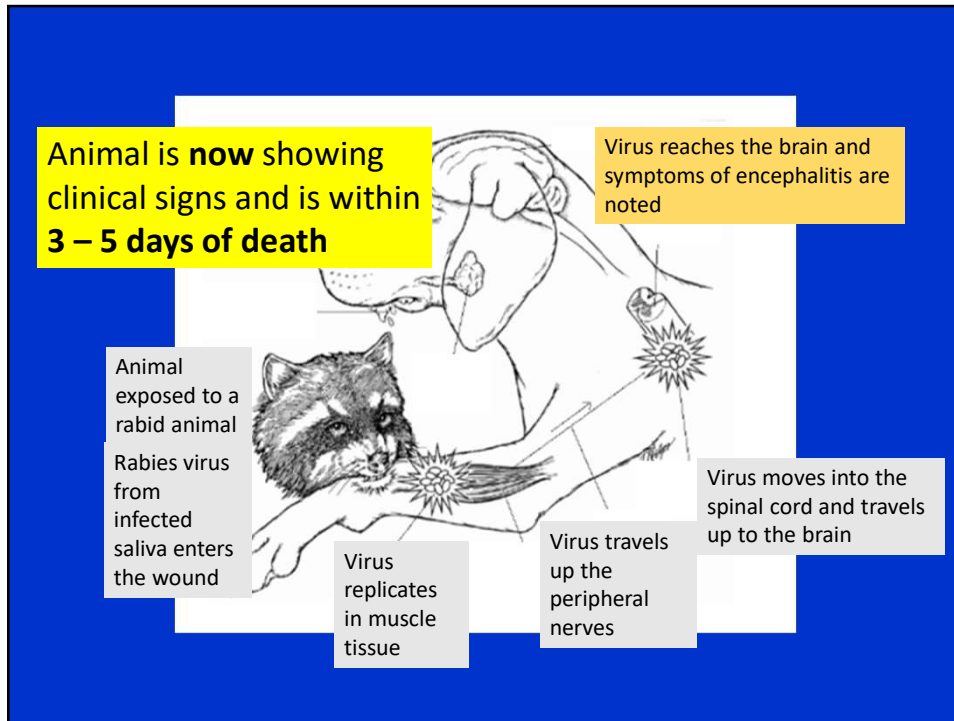
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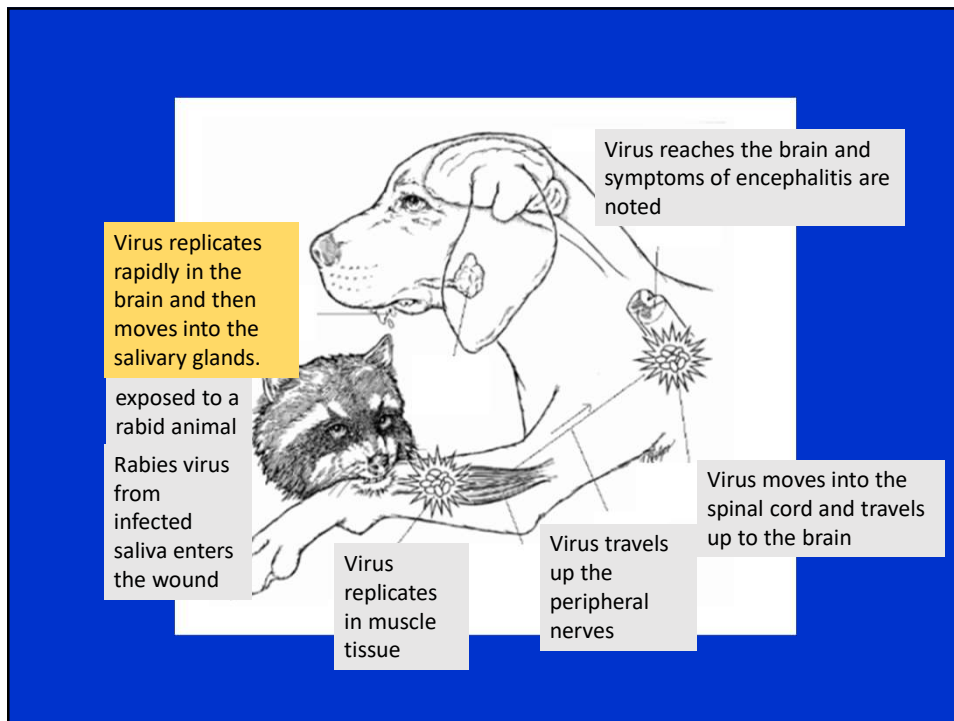
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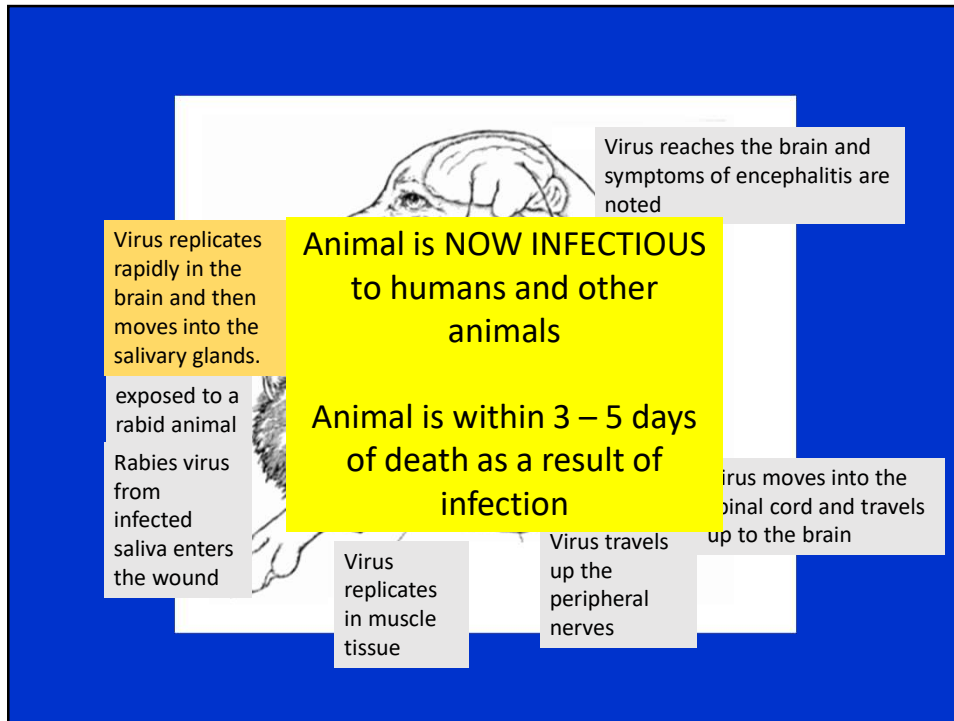
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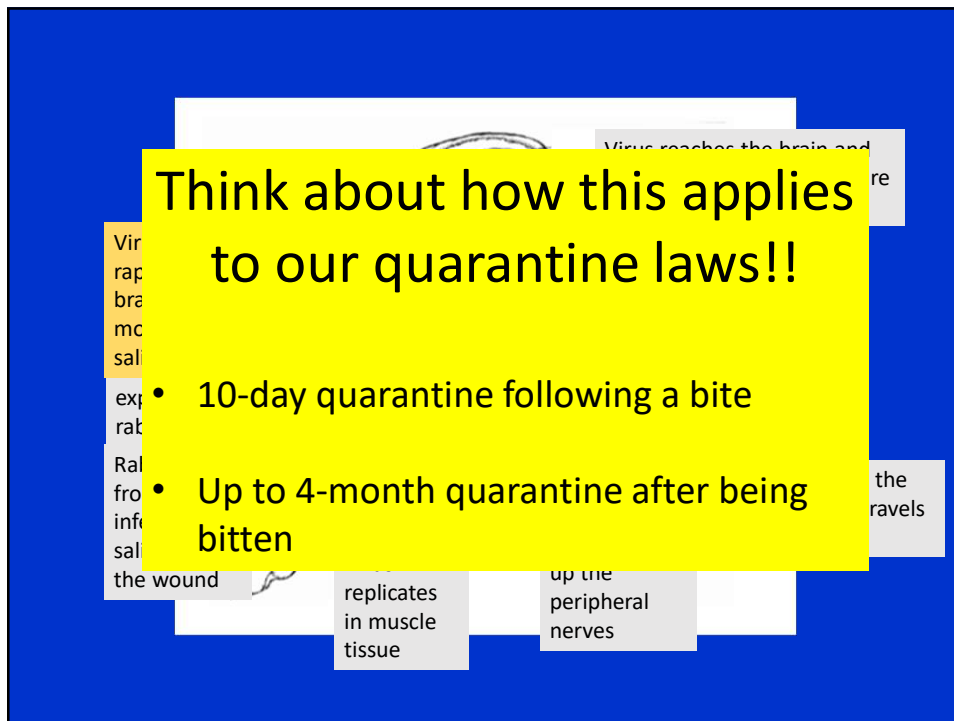
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How do we respond?



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How do we respond?

- Understand Indiana laws
- Evaluate the risk following exposure
- Testing of animals
- Treatment of the animals



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Vaccination Laws

- 345 IAC 1-5-1
 - All dogs, cats, ferrets 3 months of age and older
 - 1- and 3-year products approved, per label
 - Ferrets: approved for 1-year products only
 - First booster at end of year one for all products
 - 3-year product: 3-year interval is for the subsequent boosters
- IC 35-46-3-1
 - All dogs 6 months of age or older must be vaccinated for Rabies



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Vaccination Laws, *cont.*

- Medical Waivers, exemptions are NOT permitted
 - Animal Control Agencies may choose how to treat situations involving unvaccinated animals with underlying medical conditions.
- Titers do NOT replace a current rabies vaccination
 - Owners may refuse vaccination
 - Pets considered unvaccinated in exposure/bite situations
 - Will be required to be vaccinated according to situation



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Vaccination Laws, *cont.*

- Other Species (hybrids, racoons, etc)
 - Off Label use
 - May be vaccinated at discretion of veterinarian
 - Indiana will NOT recognize status in a bite situation
 - Animal must be sacrificed for testing
- Equine & Livestock Species
 - Not required by Indiana law
 - 4-H does require vaccine for horses



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Evaluation of Risk

Did a meaningful contact occur to allow the transmission of rabies?

- Bite Exposure
 - Any penetration of the skin by an animal's teeth
- Non-bite Exposure
 - Open wound
 - Mucous membrane



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Evaluation of Risk, *cont.*

- Bat Exposure
 - Direct contact where bite or scratch cannot be ruled out
 - Bat found in same room with
 - Sleeping person
 - Person impaired by drugs or alcohol
 - Person with intellectual disability
 - Unattended child

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**Bat bites
inflict very
limited
injury**



Wound inflicted by canine teeth of big brown bat.
Picture was taken on the same day as the bite.
Photo: CDC.

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Was the animal rabid?

- If the animal is available, then gathering evidence to answer this question is always required.
- Including in the following situations:
 - Animal is current on rabies vaccination
 - Animal does not have illness compatible with rabies
 - Animal bit a member of the household
 - Animal bit someone as it was being euthanized

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Was the animal rabid – *domestic animal?*

- ★ • Vaccine Status of the animal DOES NOT affect outcome when a domestic animal has BITTEN A HUMAN.
 - 10-day quarantine / observation of the animal
 - Submission of tissues for testing
- Vaccination status of the domestic animal is important ONLY when the animal is BITTEN OR EXPOSED.

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★ 10 Day Quarantine

- Must follow quarantine protocol, unless:
 - Euthanasia needed for humane reasons
 - Cannot be safely quarantined due to aggression*
 - *Requires state approval
- Location determined by local animal control or public health authorities
 - Home, kennel, shelter, veterinary office, etc.

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Dog v. Dog

- The biter
 - Observed for 10 days
 - Booster rabies vaccination if overdue and not medically contraindicated
- The bitee
 - Treat the wounds
 - Booster rabies vaccination if overdue and not medically contraindicated
 - If the animal dies or is euthanized, contact BOAH to determine if testing is necessary



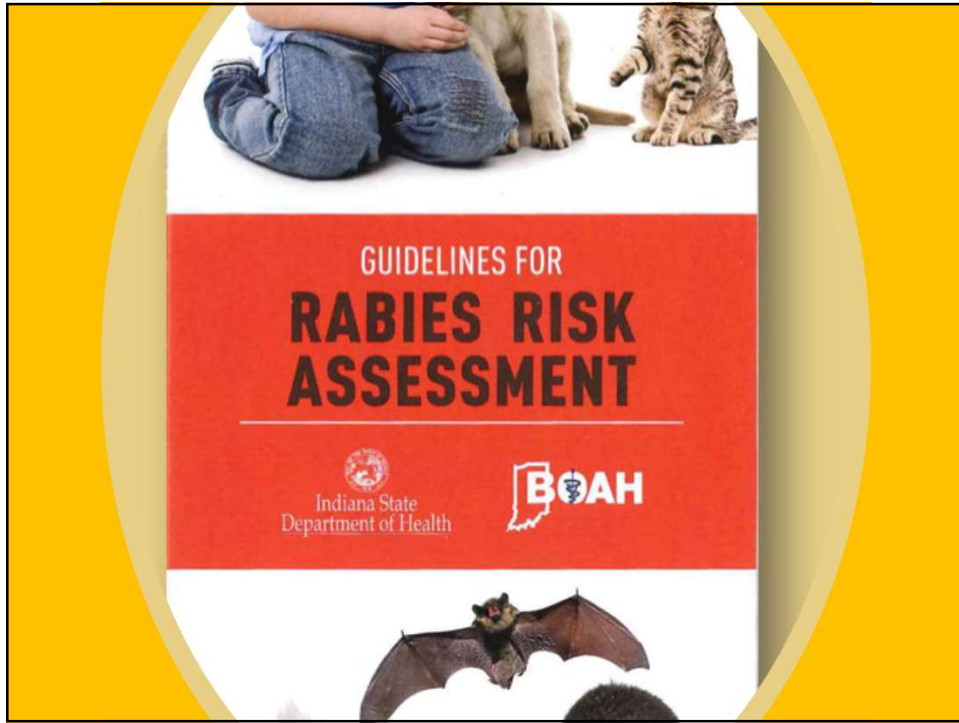
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Was the animal rabid – *wild animal?*

- Euthanize and submit tissues for testing
 - ★ • Bats – submit the entire euthanized bat
 - Wild mammals – Remove the head and submit
- Vaccination of wild animals is NOT recognized
- NO approved quarantine period for wild animals
 - Includes wolves, wolf-hybrids and exotics



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Testing of Animals

- ★ • NO live-animal test for rabies!
- The State Health Department Lab is the only provider of animal rabies testing services in Indiana (testing requested through ADDL is submitted to the IDOH lab)



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Who can submit tests?

- Any individual with the knowledge, equipment, and skills to safely collect tissues.
 - Veterinarians
 - Local Health Officials
 - Animal Welfare Officers
- Humane euthanasia of animals may be necessary

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RABIES:
ISDH Guidelines for Animal Submission

Required Materials:

1. Leak proof container or sealable plastic bags
2. Ratex specimen
3. Cold Packs
4. Leak-Not Cover Sheet (Help Desk: (317) 621-1887)
5. Rigidly sealed shipping box

NOTE: Live animals cannot be accepted for safety reasons.

1. Place animal head or entire dead bat specimen(s) in a sealable container (upper styro bag).
Completely seal bag.
2. Double bag the specimen(s) to prevent leakage during transport.
Completely seal second bag.
Place the Leak-Not Cover Sheet in a separate upper styro bag.
Completely seal bag.
3. Place the specimen(s) on the cold pack(s) inside insulated shipping box. (1 cold pack for bats, 2-3 cold packs for all other animals).
NOTE: Please do not use ice or packing peanuts during shipping.
4. Ship specimen(s) for overnight delivery to the ISDH Laboratories in an insulated shipping box within 24 hours of collection.
Ship in compliance with DOT and IATA shipping regulations for Category B packages.

For additional questions, please contact the Regional Veterinary In-Situ by Indiana State Department of Health Laboratories at 317-621-1887.

Indiana State Department of Health Laboratories

→ Live animals should NOT be submitted

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Indiana State Department of Health Laboratories

→ Bats may be submitted intact

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RABIES:
ISDH Guidelines for Animal Submission

Required Materials:

1. Leak proof container or sealable plastic bags
2. Rubber specimen
3. Cold Packs
4. Leak/Not Cover Sheet (Ship Desk: (317) 831-3837)
5. Rigidly sealed shipping box

NOTE: Live animals cannot be accepted for safety reasons.

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ISDH, 1600 State Street, 6th Floor, Indianapolis, IN 46204-1319
For additional questions, please contact the Rabies Program at (317) 831-3837 or Indiana State Department of Health Laboratories at 317-831-3838.

Indiana State Department of Health Laboratories

Dogs, cats and wild animals: decapitate the animal and submit the head to IDOH lab.





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ISDH Guidelines for Animal Submission

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For additional questions, please contact the Rabies Program at (317) 831-3837 or Indiana State Department of Health Laboratories at 317-831-3838.

Indiana State Department of Health Laboratories

Livestock: decapitate the animal and submit the head to ADDL

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RABIES:
ISDH Guidelines for Animal Submission

Required Materials:

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2. Ratex specimen
3. Cold Packs
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IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT US AT:
ISDH, 400 W. Washington, Indianapolis, IN 46204-1333
Phone: (317) 621-1887
Fax: (317) 621-1888
Email: isdh@indiana.gov

Indiana State Department of Health Laboratories

→ Ship the specimen on ice





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Fax: (317) 621-1888
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Indiana State Department of Health Laboratories

→ Specimens may be refrigerated for up to 72 hours

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Freezing tissues delays test results

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Indiana State Department of Health Laboratories

Ship samples for overnight delivery during regular business hours

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IN 90V An official website of the Indiana State Government Accessibility Settings Language Translation Governor E

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Keeping Pets and People Safe from Rabies
Presented by Indiana Department of Health and Indiana State Board of Animal Health
Learn more

Reporting Animal Bites Animal Rabies Sample Submission Handling Animal Bites Pet Vaccination Laws Rabies Maps and Statistics

Scroll for more

Submission Form
[in.gov/rabies/rabies-sample-submission/](https://www.in.gov/rabies/rabies-sample-submission/)

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Resources

- www.in.gov/rabies
- Rabies Slide Card
- ISDH guidelines for submission
- Human Exposures
 - Local County Health Department
 - IN State Health Department
- Animal Exposures
 - IN State Board of Animal Health
 - Melissa Justice – 317-439-4888



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Other Important Zoonotic Diseases



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Gastrointestinal Infections

- **Bacterial**
 - Salmonella
 - Campylobacter
 - E. coli
- **Parasitic**
 - Giardia
 - Roundworms
 - Echinococcus species tapeworms



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GI Infections, *cont.*

- Acquired through contact or ingestion of fecal material from infected animals.
- Infected animals typically have diarrhea
- ★ • Some infected animals may show NO clinical signs of illness
- Symptoms in people include:
 - Abdominal pain
 - Diarrhea
 - Fever



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Skin Infections

- Ringworm



Photo Credit – CDC PHIL 18469



Photo credit: American Kennel Club

- Mange



Photo Credit – CDC PHIL 15351



Photo Credit – CDC PHIL 14486



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Skin Infections, *cont.*

- Infection occurs following direct contact with affected animals or contaminated bedding.
- Symptoms in animals may include:
 - Skin irritation
 - Itching
 - Self-inflicted wounds
 - Hair loss
- Clinical signs in people:
 - Skin irritation / rash
 - Itching



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Rare Infections

- Brucellosis
- Tularemia
- Leptospirosis
- Toxoplasmosis



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Brucellosis

- Bacterial infection which causes reproductive disease in dogs, cattle, sheep, goats, swine, cervids and bison
- Can be transmitted by contact with infected animals, exposure to abortive tissues, exposure to bodily fluids such as urine or semen
- Clinical signs include flu-like symptoms:
 - Fever
 - Back pain
 - Headaches
 - Weakness



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Tularemia

- Bacterial infection of wild rodents and rabbits.
- May infect dogs, especially hunting dogs
- Infection occurs through exposure to tick or deer fly (vector), body fluids and tissues, ingestion of contaminated water or inhalation of contaminated dust.
- Clinical signs in animals include:
 - High fever
 - Lethargy
 - Lymph node swelling
 - Lameness
 - Decreased appetite



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Tularemia, *cont.*

- Clinical signs in animals include:

- High fever
- Lymph node swelling
- Decreased appetite
- Lethargy
- Lameness



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Tularemia, *cont.*

- Clinical signs in humans include:

- Fever
- Headache
- Lymph node swelling
- Rash
- Eye inflammation
- Skin Ulcers



Photo Credit – CDC PHIL #1344

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Leptospirosis

- Bacterial disease of wild rodents, rabbits and dogs
- Highest risk in dogs that hunt or drink contaminated water
- Bacteria is shed in the urine of infected animals
- Clinical signs in dogs:
 - Fever
 - Lethargy
 - Decreased appetite
 - Vomiting
 - Vomiting
 - Diarrhea
 - Jaundice
 - Changes in urination



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Leptospirosis, *cont.*

- Can lead to kidney or liver failure in animals
- Clinical signs in dogs:
 - Fever
 - Lethargy
 - Decreased appetite
 - Vomiting
 - Diarrhea
 - Jaundice
 - Changes in urination



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Leptospirosis, *cont.*

- Human infection occurs through contact with urine or other infected fluids or materials
- Clinical signs in people:
 - Fever
 - Headache
 - Abdominal and muscle pain
 - Vomiting
 - Diarrhea
 - Jaundice
 - Rash



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Toxoplasmosis

- Healthy individuals rarely have clinical signs
- Immune Compromised individuals and Pregnant women at greatest risk, especially with exposure to infected cats
- Clinical signs in cats generally not noticed, but can cause fever, lethargy, ocular or neurologic issues
- Clinical signs in people include flu-like symptoms, ocular or neurologic issues or birth defects in infants exposed in the womb.



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