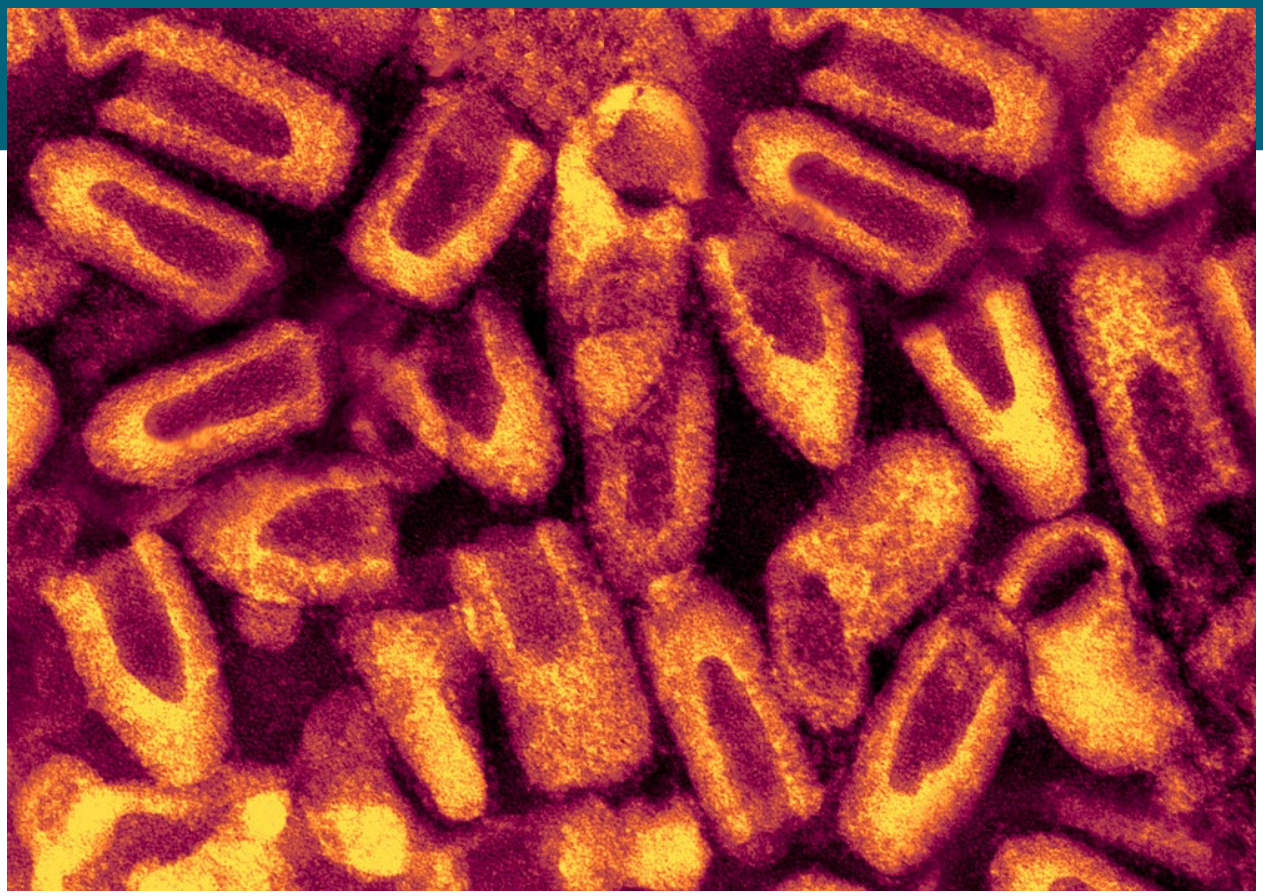


Rabies Resource Manual

July 2026

Prepared by:

Iowa Department of Agriculture and Land Stewardship (IDALS)
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About this manual

Acknowledgements:

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- The Iowa veterinarians who volunteered their time to review the updates to this manual and provided feedback from a user perspective."
- Dr. Russ Benedict, Director of Prairies for Agriculture Project in the Department of Biology at Central College, for sharing his knowledge and the Bats of Iowa Identification Guide.
- The Montana Department of Health and Human Services for sharing their bat euthanasia guide.

Audience:

The intended audience of the Rabies Resource Manual is local public health agencies, animal control authorities, veterinarians and any entity involved with enforcing local rabies ordinances, administering rabies vaccines to animals, and/or submitting animals for the purposes of rabies testing. In Iowa, and dependent on the local jurisdiction, this can include law enforcement such as the sheriff or police department.

Previous versions of this document:

- Previous version released on March 24, 2016.
- The most recent version of this document is available at:
  Rabies - Information for Public, Providers and Veterinarians | Iowa HHS

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Rabies Background

Virus

Enveloped, neurotropic RNA virus. Note, enveloped viruses are more easily destroyed by environmental conditions than non-enveloped viruses.

Transmission

Virus carried in saliva or neural tissue of rabid animals and spreads through broken skin or direct exposures to mucous membranes. When saliva or neural tissue is dry, the virus is inactivated (i.e., no longer infectious). The virus is not found in blood, feces, or urine. There are no evidence-based reports of human rabies arising from consumption of milk, including breastmilk, or cooked meat.

Once in a nerve the virus moves at a rate of 50 to 100 mm/day. For context, the sciatic nerve (longest nerve in the human body) has an average length of 1 m (1000 mm).

Incubation

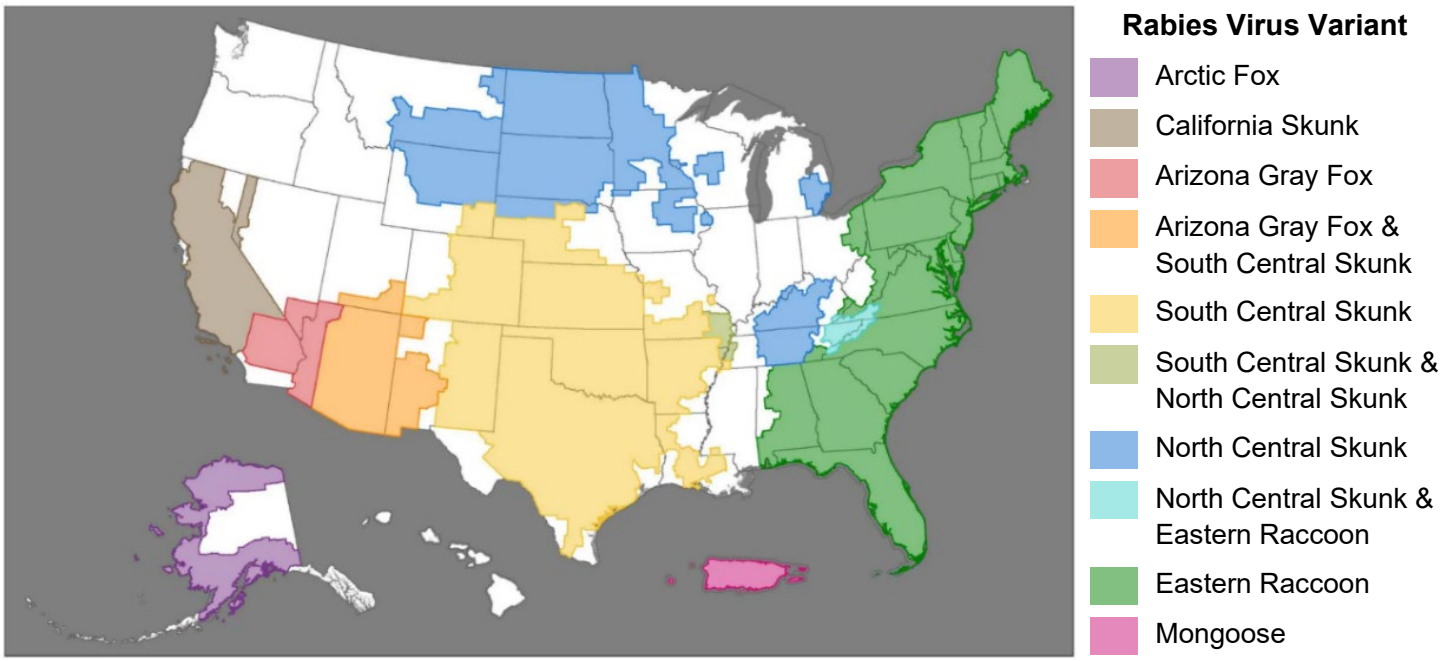
In animals, the incubation period is usually 2 to 3 weeks to 3 months, but it has been reported to range from a few days to 6 months.

In humans, the incubation period is usually 3 to 8 weeks after exposure but can range from a few days to years.

Epidemiology

In the Midwest, skunks are the most common terrestrial (land) reservoir, with the north central skunk variant found in Iowa. The terrestrial reservoir changes in different areas of the U.S.

Rabies Variant Territories in the U.S.



Bats are a reservoir everywhere in the U.S., with approximately 3 to 4% of bats submitted in Iowa testing positive yearly. While highly prevalent on the East Coast, the last time a rabid raccoon was detected in Iowa was in the year 2000.

The canine rabies variant has been eradicated from the U.S. since 2008. The canine variant is still most prevalent worldwide and causes 99% of human cases globally.

Rabies is rare in people in the United States, with only 1 to 3 cases reported each year. However, each year about 60,000 Americans receive PEP following an exposure. The last human case in Iowa was **2002** from a bat variant. The most recent cases in neighboring states are:

- **2024** – Minnesota (bat variant)
- **2024** – Nebraska (bat variant)
- **2021** – Illinois (bat variant)
- **2011** – Wisconsin (bat variant)
- **2008** – Missouri (bat variant)
- **1970** – South Dakota (skunk variant)
- **1968** – Kansas (canine variant)

Iowa Code

Iowa Code, Chapter 351 (Dogs and Other Animals) includes all relevant state law related to rabies in Iowa. Selected subsections are:

- §351.28 places the liability for a dog that injures someone on the owner of the dog.
- §351.33 requires all dogs over 6 months of age, allowed to leave their home property, to be vaccinated against rabies. There is no state requirement for cats.
- §351.36 gives authority to local health **and** law enforcement officials.
  - Iowa Code grants both enforcement authority. It is not either/or.
- §351.38 defines reporting duty
  - Requires anyone with knowledge of an animal that has bitten or attacked a person to report it to the local authority. Requires physicians and veterinarians to report rabid animals.
- §351.39 defines the local confinement authority.
  - This is what gives local jurisdictions the authority to mandate the 10-day confinement periods used to rule out rabies risk.
- §351.40 defines the local quarantine authority. This is not for 10-day confinements but instead for an entire jurisdiction or part of a jurisdiction. This would only be needed in the event of a large-scale rabies outbreak in dogs.



Confinement Authority and Enforcement

A list of local confinement authorities, authorized by §351.36 and §351.39, is available at **Rabies | Health & Human Services**. To access it, open that page, go to the “Veterinarians” section, and then select the “Animal Confinement “subsection. There, you will find a link to the complete list that includes the contact information for each local authority.

Investigation & Follow-up Authority

Iowa Code (§351.36 and §351.39) gives the local confinement authority to the jurisdiction where the animal resides and exclusive authority to act, including testing, confinement or quarantine.

Iowa Code does not assign responsibility for:

- Educating the exposed person (victim) about PEP recommendations.
- Communicating the outcome of actions taken regarding the animal to the exposed person (victim).

Therefore, victim follow-up and education may require interjurisdictional coordination.

Clear communication is key.
All jurisdictions involved should communicate at the start of the process so it is clear who is following up with the victim (person exposed) and avoid duplication of efforts.

Recommended Best Practices for Local Agencies

Follow these steps to ensure clarity and coordination:

- Identify animal's residency.
- Identify victim's residency.
- Coordinate with other local jurisdictions as needed.
- Ensure victim receives timely updates on testing, confinement or quarantine results.
- Avoid duplicate follow-up efforts.

The jurisdiction where the victim lives should take lead on follow-up. If the exposed person resides in your jurisdiction, attempt follow-up to inform them of the outcome of any testing, confinement, or quarantine ordered by the animal's jurisdiction. If the animal lives in your jurisdiction, ensure the victim is informed of the outcome of any testing, confinement, or quarantine mandated by your jurisdiction. If information on residence is not known, the jurisdiction where the incident occurred should follow up, at minimum, until correct residence is established.

It is not necessary to plan for every scenario with all local jurisdictions in Iowa. Cross-jurisdiction traffic is usually limited geographically. Consider reviewing your animal bite data from the previous year to identify jurisdictions with frequent interactions. Bite reports typically peak during summer months, so consider seasonal trends when reviewing data.

Example Scenarios

Scenario	Follow-Up	Notes
Dog lives in County X; victim lives in County Y	County X acts on animal; County X or County Y may notify victim	County X and County Y communicate to ensure timely follow-up.
Visitor (residence unknown) bitten in County X; animal lives in County X	Jurisdiction (County X) where incident occurred	Once visitor residence is determined, coordinate with victim's home jurisdiction.
Resident bitten in County X but dog owner unknown	Jurisdiction (County X) where incident occurred	Once animal residence is determined, that jurisdiction has authority over the animal; coordinate to communicate outcome to victim.

Animal Confinement & Observation

Dogs, cats, and ferrets that have bitten or potentially exposed a person to rabies should be confined and observed for 10 days, *regardless of their rabies vaccination status*.



The rabies vaccination status of the attacking (biting) dog, cat or ferret does not impact the 10-day confinement and observation requirement. **Both vaccinated and unvaccinated dogs, cats and ferrets should undergo a 10-day confinement and observation.** This rules out the risk of rabies during the encounter in question.

- If at any time during the 10 days, a dog, cat or ferret is showing signs of rabies, they should be immediately euthanized and tested.
- Iowa Code **does not** dictate where a confinement and observation period must occur. This is at the discretion of the local authority.
  - Throughout the U.S., many jurisdictions allow home confinement under owner supervision when appropriate. The most important part of a confinement and observation period is to validate that the attacking (biting) dog, cat or ferret is still alive at the end of the 10 days.
- Iowa Code §351.38 requires veterinarians (and physicians) to report to the local rabies authority any animal known or suspected to be rabid. Local points of contact can be found on the Iowa HHS Rabies webpage under “Animal Confinement” within the “**Veterinarians**” section.

Animal Testing

When confinement and observation is not possible for a domestic animal, every attempt should be made to test an animal that potentially exposed a person to determine if that person needs post-exposure prophylaxis (PEP).

Failure to provide the correct samples will compromise the ability to perform rabies testing. Always ensure the brain of the animal being tested is intact. The easiest way to achieve this is submitting the entire head or the whole carcass.

Laboratory Information

There are two laboratories in Iowa that provide animal rabies testing services and testing requires examination of the animal's brain, so the animal should be euthanized without damaging the head. Complete submission guidelines are available on each laboratory's respective webpage.

Iowa Laboratories Providing Animal Rabies Testing Services

	State Hygienic Laboratory at the University of Iowa (SHL)	Iowa State University Veterinary Diagnostic Laboratory (VDL)
Business hours testing	▪ If a **person** has had direct contact with a suspected or known rabid animal, the animal can be tested at no cost. ▪ If a **pet** had contact with the animal, the animal can be tested at the submitter's expense.	▪ If a **person** or **domestic animal** had direct contact with a suspected or known rabid animal, the animal can be tested at the submitter's expense. ▪ Animals not known to have exposed a person or pet can also be tested for diagnostic purposes.
After-hours & Sunday testing	Yes, to rule out rabies risk to a person. Requires approval from the State Public Health Veterinarian.	Yes, available for an additional fee.
Specimens accepted	▪ Whole animal (≤1 pound) ▪ Head only (>1 pound)	Will accept whole animals of any size/type (no weight limit)
Additional testing offered	No, only rabies testing is available for animals.	Yes, full diagnostic testing available for all types of animals.

Sample Submission Guidance

While each laboratory has detailed guides on their respective webpages on how to extract the brain and then cross section the cerebellum and brainstem, the safest and easiest option is to remove the entire head through disarticulation of the atlantooccipital joint and then submitting the entire head to the respective laboratory. If in doubt about the location of the atlantooccipital joint, leave as much neck as possible, disarticulating close to the shoulders. For very small animals (bats, rodents, etc.) submitting the entire body is easiest.

Differential testing considerations if rabies is ruled out

This list is not exhaustive and instead provides various testing options to consider at VDL once rabies has been ruled out in an animal with compatible clinical signs.

Animal	Testing Options to Consider	
Dogs	▶ Infectious ■ Canine distemper virus ■ Pseudorabies virus ■ Bacterial meningitis/encephalitis ■ Tick-borne encephalitis	▶ Toxicosis ▶ Neoplasia
Cats	▶ Infectious ■ Feline infectious peritonitis (neurologic/dry form) ■ *Toxoplasma gondii* ■ Avian Influenza ■ Cryptococcosis ■ Pseudorabies virus	▶ Toxicosis ▶ Neoplasia
Cattle	▶ Infectious ■ *Listeria monocytogenes* ■ *Histophilus somni* (thrombotic meningoencephalitis) ■ Pseudorabies virus	▶ Toxicosis ▶ Trauma (should be explored at the time of death/euthanasia) ■ Rattlesnake bite to the tongue ■ Penetrating oral foreign body
Horses	▶ Infectious ■ West Nile virus (WNV) ■ Equine herpesvirus-1 (EHV-1 / EHM) ■ Equine protozoal myeloencephalitis (EPM) ■ Other viral encephalitides (Eastern/Western/Venezuelan equine encephalitis) ■ *Clostridium botulinum*	▶ Toxicosis ▶ Neoplasia

Information on specific diagnostic tests, including fees, is available at **Tests/Fees - Veterinary Diagnostic Laboratory**.

Bat Euthanasia Guidance for Veterinarians

All bats that come into direct contact (skin-to-skin) with a person are assumed rabid since they are the predominant rabies reservoir in Iowa. When contacted by a client or member of the public regarding exposure of a person or pet to a bat, euthanizing the bat and submitting it for testing is the only way to rule out the risk of rabies and thus the need for post-exposure prophylaxis (PEP) for people or quarantine for domestic animals. Humane euthanasia of bats that potentially exposed a person to rabies can be performed with common supplies and equipment found in a veterinary clinic.

Bat Euthanasia Methods

Acceptable euthanasia methods:

Inhalant anesthetics

- Liquid isoflurane or sevoflurane: 5 mL per bat in a small, closed container.
- Carbon dioxide (CO_2 at 70% or higher concentrations). This method should be paired with other methods to ensure death due to CO_2 resistance in insectivorous bats.

Injectable agents (IV or IP)

- Barbiturates (euthanasia solution), dissociative agent combinations (ketamine/diazepam or ketamine/xylazine), or 70% Ethanol IP in bats smaller than a mouse.

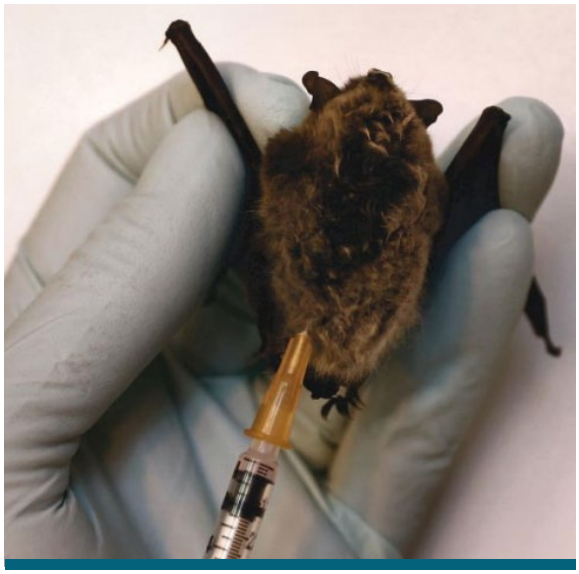
Unacceptable bat euthanasia methods:

- Cervical dislocation or decapitation
- Exhaust fumes
- Diethyl ether
- Blunt force
- Drowning
- Gunshot
- Thoracic compression
- Freezing

Bat Euthanasia Procedure

Example of an acceptable bat euthanasia procedure:

1. Work in a well-ventilated area.
2. Wear leather gloves with large exam gloves over the leather gloves (this eliminates inadvertent transmission of disease between the bat and future patients via the leather gloves).
3. The bat should be presented in a small container with breathing holes. If bat is presented in an excessively large container, carefully move it to a suitable container.
4. Place the small container holding the bat into a larger container that can be sealed (i.e., Tupperware). Do not remove the bat from the smaller container before placing it in the larger container.
5. Saturate a cotton ball with 5 mL of isoflurane (place cotton ball in plastic prescription vial and pour isoflurane into vial).
6. Place the cotton ball (or open plastic vial) into the larger outer container and seal the lid.
7. Wait for 15 minutes before checking the bat. Carefully confirm that the bat has expired by looking for absence of breath, movement, or reaction to stimuli.
    a. If bat is sedated but not deceased, administer injectable euthanasia agent.
        i. Use gloved hands to restrain the bat with the abdomen facing up.
        ii. Draw an imaginary line between the bat's knees and insert the needle at a 30-degree angle along that line on the bat's right side, close to midline.
        iii. Advance the needle about ½ centimeter into the abdomen.
        iv. Draw back on the needle.
            - If fluid enters the syringe, pull back the needle, reposition and draw back again.
            - If no fluid is aspirated in the syringe, inject the euthanasia solution.



(Above) Intraperitoneal injection site; picture courtesy of Michigan Rabies Working Group

8. Dispose of the used cotton ball and exam gloves in a well-ventilated area.
9. Wash hands with soap and water after removing gloves.

Precautions:

- Minimize people present during euthanasia.
- Pregnant women or immunocompromised people should not be present during bat collection and/or euthanasia.
- Only vaccinated and properly trained people should euthanize bats.
- Wear leather gloves at all times and minimize direct contact, regardless of whether the bat is alive or dead.
- Avoid excessive inhalation of inhalant anesthetic when this method is performed.

Important Considerations:

- Bats should never be handled with bare hands.
- Ideally, all personnel handling bats for euthanasia should be previously vaccinated against rabies.
- Cervical dislocation/decapitation are unacceptable methods for euthanasia of bats due to concern for rabies exposure.
- Every attempt should be made to terminate a bat's life with an acceptable euthanasia method.
- The priority for public health agencies is to preserve the bat's brain for rabies testing.
- Do not place the specimen in formalin or another fixative.
- Do not freeze. The bat can be refrigerated if needed.
- Submit whole bat as soon as possible. There is no need to decapitate it.



Disinfecting Potentially Contaminated Surfaces

Rabies virus is fragile and easily “killed” under normal environmental conditions and most cleaning practices. Standard cleaning and disinfection protocols should be sufficient to destroy any virus in the environment.

Factors that destroy rabies virus:

Desiccation (Drying Out):

The virus is fragile and does not survive well in a dry environment. Once saliva containing the virus dries, the virus is inactivated.

Ultraviolet Light (Sunlight):

Exposure to ultraviolet (UV) light, particularly direct sunlight, quickly destroys the rabies virus.

Disinfectants:

A range of disinfectants commonly used in homes and hospitals are lethal to the rabies virus. These include, but are not limited to:

- **Bleach** (Sodium Hypochlorite):
  A 1:10 dilution of bleach in water (1 part bleach to 9 parts water), with a contact time of 15 minutes, is extremely effective.
- **Alcohol**:
  Solutions of 43% to 70% alcohol (like isopropyl or ethyl alcohol) rapidly inactivate the virus.
- **Iodine Solutions**:
  5-7% iodine solutions are potent disinfectants against the rabies virus.
- **Quaternary Ammonium Compounds**:
  These disinfectants, when properly diluted, can also be used to destroy the rabies virus. A 1:500 dilution can be effective.
- **Povidone-Iodine**:
  This agent is a powerful virucidal option.

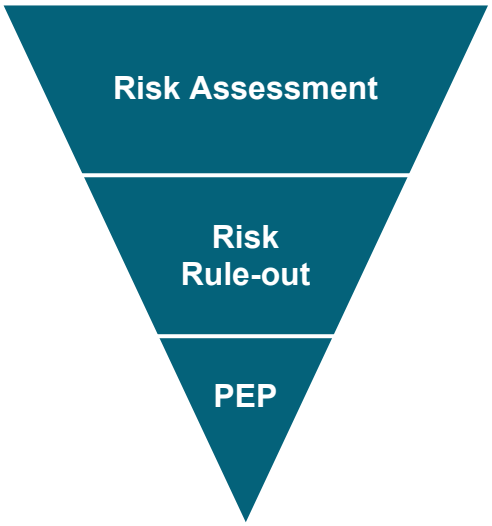
Common Detergents:

Many household detergents, especially soaps, are highly effective at disrupting the virus’s structure, leading to its inactivation. Regular hand soap, dish soap, and other detergents can effectively neutralize rabies virus on contaminated surfaces.



If the material containing the virus is dry, the virus can be considered noninfectious.

Post-exposure prophylaxis (PEP) in Humans



A risk assessment should always be completed as the first step when making the decision to administer PEP to a person. This process can be visualized as an upside-down triangle.

Complete details on conducting a rabies risk assessment and when PEP is warranted (including administration tables, biologics info, and serology testing) are available in the **Iowa HHS Epi Manual chapter on rabies**.

Important!

A tetanus toxoid-containing vaccine is indicated as part of wound management if more than five years has passed since the last tetanus toxoid-containing vaccine dose.

Complete details at **Prevention of Pertussis, Tetanus, and Diphtheria with Vaccines in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP)**

Quick Reference for Not Previously Vaccinated*



*** Note:** See Epi Manual for immunocompromised persons; ** RIG = immune globulin

Quick Reference for Previously Vaccinated



PEP for Veterinarians

Most veterinarians in the U.S. receive a pre-exposure prophylaxis (PrEP) when starting veterinary college. Therefore, rabies RIG (immune globulin) is rarely, if ever, needed when PEP is warranted for a veterinarian. This is also true for any person that completed a PEP or PrEP series in the past.

Pre-exposure prophylaxis (PrEP) in Humans

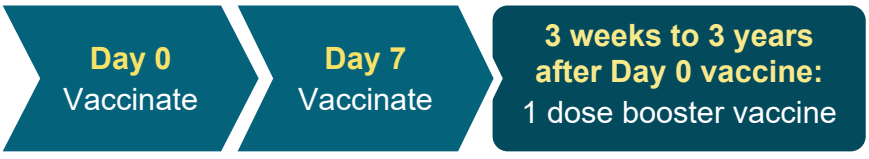
The PrEP series was reduced from three vaccines to two vaccines in 2022. Complete details for administration protocols and the correct vaccine schedule are available in the **Iowa HHS Epi Manual rabies chapter**. **Persons that completed the PrEP series do not need RIG (immune globulin) after potential rabies exposures.**

Risk category	Person(s) typically* affected	Recommendations
Risk category 1 ***Highest risk***	People who work with live or concentrated rabies virus in laboratories	▪ 2 doses, days 0 and 7 ▪ Check titer every 6 months
Risk category 2	People who frequently do at least one of the following: handle bats, have contact with bats, enter high-density bat environments like caves or perform animal necropsies	▪ 2 doses, days 0 and 7 ▪ Check titer every 2 years
Risk category 3	People who interact with, or are at higher risk to interact with, mammals other than bats that could be rabid, for a period longer than three years after they receive PrEP. This group includes: ▪ Most veterinarians, veterinary technicians, animal control officers, wildlife biologists, trappers, rehabilitators and spelunkers (cave explorers) ▪ Certain travelers to regions outside the U.S. where rabies in dogs is commonly found	2 doses, days 0 and 7, *plus*: ▪ ***Either*** a one-time titer check after 1 year and up to 3 years following the first 2-dose vaccination, ***or*** ▪ 1-dose booster between 3 weeks and 3 years following the first vaccine in the 2-dose vaccination
Risk category 4	Same population as risk category 3 but at a higher risk for ≤ 3 years after they receive PrEP	2 doses, days 0 and 7
Risk category 5 ***Lowest risk***	General U.S. population	None

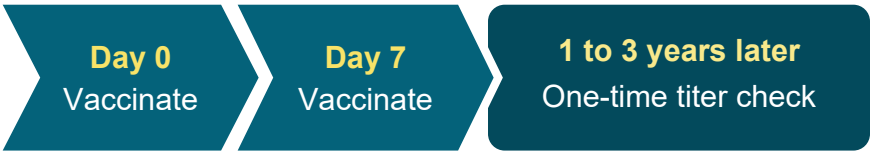
**Typical characteristics described may not include characteristics of all activities within the described risk group*

Quick Reference for Risk Category 3 Vaccination Timing

Option *without* Titer Check



Option *with* Titer Check



Titer Check Recommendations

The recommendation on checking titers changed in 2022; it is now based on new risk categories.

Multiple titer checks are **no longer recommended** for most of the following during their lifetimes: veterinarians, veterinary technicians, animal control officers, wildlife biologists, rehabilitators, trappers and cave explorers.

Rabies Titers

The level recommended by the World Health Organization (WHO) as an adequate response to vaccination is 0.5 IU/mL. This value is not a level of protection but rather the minimum level determined after evaluation of peak responses in early human clinical trial studies. Therefore, **titers do not equal protection.** Regardless of the titer, or when it was obtained, it never eliminates the need for PEP after an exposure.

Detailed information on where to order titers is available in the Epi Manual chapter: **Rabies | Health & Human Services**.

Most veterinarians, veterinary technicians, animal control officers, wildlife biologists and rehabilitators fall into Risk Category 3.

The recommended frequency for titer checks for this group is now **either:**

- A one-time check after 1 year and up to 3 years following the 2-dose PrEP vaccination series, ***or***
- If a 1-dose booster is given between 3 weeks and 3 years following the first vaccine in a 2-dose PrEP vaccination series, never.

There is no longer a recommendation to check titers in these groups every 2 years.

Animals and Animal Exposures

There is no state requirement to quarantine an animal potentially exposed to rabies in Iowa. However, there are recommended quarantine periods based on the nature of the exposure. Iowa HHS and IDALS have developed a table walking through the various animal on animal exposure scenarios and the recommended confinement/quarantine period as well as rabies booster administration.

If rabies can be ruled out in the attacking (biting)/exposing animal, no action is needed for the victim/exposed animal.

A PDF and printable version of the following table as standalone document is available at **Rabies | Health & Human Services** in the “Animal Quarantine” area within the “Veterinarians” section.

IOWA | Health and Human Services

Recommended Rabies Observation, Confinement, and Quarantine Periods for Animals in Iowa

This table is intended to assist local public health agencies and veterinarians in Iowa when making decisions on the proper period of time to observe, confine, or quarantine an animal that may have exposed a person to rabies or potentially was exposed to rabies after attacked by another animal. For extended observation/confinement/quarantine periods (>10 days), if possible and practical, testing the exposing animal is preferred versus the prolonged time required to monitor the exposed animal for the development of rabies. An exposing animal testing negative automatically ends the observation/confinement/observation period for the exposed animal.

In the table:

- **Proof of vaccine** equals documentation of receiving at least one USDA-licensed rabies vaccine.
- **Observation** refers to keeping an animal under the owner's control and observation.
- **Confinement,** per Iowa Code 351.39, is at the authority and discretion of local boards of health. This can include both in-home and out-of-home confinements, depending on local ordinances.
- **Strict quarantine** refers to confinement in an enclosure that precludes direct contact with people and other animals.

Exposing Animal
(Animal that attacks)

Exposed Animal
(Animal that was attacked)

When reviewing the table when a timeframe is not specifically indicated for the proper length to observe/confine/or quarantine an animal, consult with a veterinarian at the Iowa Department of Health and Human Services (Iowa HHS) or the Iowa Department of Agriculture and Land Stewardship (IDALS).

To contact an Iowa HHS Veterinarian

515-336-4287
during business hours

515-323-4360 after hours
(the Iowa State Patrol will contact the person on call)

rabies@hhs.iowa.gov

To contact an IDALS Veterinarian

515-281-5305
during business hours

515-242-0247 after hours

Scan the QR code to learn more

hhs.iowa.gov/center-acute-disease-epidemiology/rabies-information-public-providers-and-veterinarians







Exposure Event		Vaccination Status	Vaccination Schedule	Confinement / Observation Period
Dog, Cat, or Ferret vs. Human	⚠	Exposing Animal is Current	Exposing Animal: none	Exposing Animal: 10 days
	⚠	Exposing Animal is **not** Current	Exposing Animal: at conclusion of Day 10	
Livestock vs. Human	⚠	Exposing Animal is Current	**Case-by-case:** Other animals that might have exposed a person to rabies should be reported immediately to the local health department. Management of animals other than dogs, cats, and ferrets depends on the species, the circumstances of the exposure, the epidemiology of rabies in the area, the exposing animal's history and current health status, and the animal's potential for exposure to rabies. The shedding period for rabies virus is undetermined for most species. Previous vaccination of these animals might not preclude the necessity for euthanasia and testing.	
	⚠	Exposing Animal is **not** Current		
High Risk Wildlife **(1)** vs. Dog, Cat, or Ferret	✚	Exposed Animal is Current	Exposed Animal: immediately **(2)**	Exposed Animal: 45 days
	✚	Exposed Animal is Overdue *(with Proof of Vaccine)* **(3)**	Exposed Animal: immediately **(2)**	Exposed Animal: 45 days **(4)**
	✚	Exposed Animal has **no** Proof of Vaccine	Exposed Animal: within 96 hour (4 days)	Exposed Animal: 4 months **(5)**
High Risk Wildlife **(1)** vs. Livestock	✚	Exposed Animal is Current	Exposed Animal: immediately **(6)**	Exposed Animal: 45 days **(6)**
	✚	Exposed Animal is Overdue *(with Proof of Vaccine)*	**Case-by-case** basis, taking into consideration factors such as severity of exposure, time elapsed since last vaccination, number of previous vaccinations, current health status, and local rabies epidemiology, to determine need for euthanasia or immediate booster vaccination followed by observation or strict quarantine.	
	✚	Exposed Animal has **no** Proof of Vaccine	Consider euthanizing livestock that have never been vaccinated. Livestock that are not euthanized should be confined and observed on a **case-by-case** basis for 6 months.	

(1) High risk wildlife in Iowa includes skunks, bats, raccoons, foxes, and coyotes.

(2) If booster vaccination is delayed consider increasing the observation period for the animal, taking into consideration factors such as the severity of exposure, the length of delay in booster vaccination, current health status, and local rabies epidemiology.

(3) Ferrets that are overdue for a booster vaccination should be evaluated on a **case-by-case** basis, taking into consideration factors such as the severity of exposure, time elapsed since last vaccination, number of previous vaccinations, current health status, and local rabies epidemiology, to determine need for euthanasia or immediate booster vaccination followed by observation or strict quarantine.

(4) If booster is delayed beyond 96 hours, contact a veterinarian at Iowa HHS or IDALS.

(5) If vaccinated after 96 hours consider extending strict quarantine to 6 months.

(6) For livestock, if not boostered immediately, consult with the Iowa Department of Agriculture and Land Stewardship.

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Exposure Event		Vaccination Status	Vaccination Schedule	Confinement / Observation Period
Dog, Cat, or Ferret vs. Dog, Cat, or Ferret *(if Exposing animal is located)*		Exposing Animal *(any status)* & Exposed Animal is Current	Exposing Animal: if not up-to-date, at conclusion of Day 10 Exposed Animal: immediately if Exposing animal fails confinement or tests positive	Exposing Animal: 10 days Exposed Animal: none **(7)**
		Exposing Animal *(any status)* & Exposed Animal is Overdue *(with Proof of Vaccine)* **(3)**	Exposing Animal: if not up-to-date, at conclusion of Day 10 Exposed Animal: immediately **(2)**	Exposing Animal: 10 days Exposed Animal: none **(8)**
		Exposing Animal *(any status)* & Exposed Animal has **no** Proof of Vaccine	Exposing Animal: if not up-to-date, at conclusion of Day 10 Exposed Animal: immediately **(2)**	Exposing Animal: 10 days Exposed Animal: none **(9)**
Dog, Cat, or Ferret vs. Dog, Cat, or Ferret *(if Exposing animal is not located)* **(10)**		Exposed Animal is Current	Exposed Animal: immediately **(2)**	Exposed Animal: 45 days
		Exposed Animal has **no** Proof of Vaccine	Exposed Animal: within 96 hours (4 days)	Exposed Animal: 4 months **(5)**
Low Risk Wildlife **(11)** vs. Domestic Animal		**Case-by-case** basis *(i.e. was the exposing wildlife acting erratically, strangely, etc.)*.		

(1) High risk wildlife in Iowa includes skunks, bats, raccoons, foxes, and coyotes.

(2) If booster vaccination is delayed consider increasing the observation period for the animal, taking into consideration factors such as the severity of exposure, the length of delay in booster vaccination, current health status, and local rabies epidemiology.

(3) Ferrets that are overdue for a booster vaccination should be evaluated on a **case-by-case** basis, taking into consideration factors such as the severity of exposure, time elapsed since last vaccination, number of previous vaccinations, current health status, and local rabies epidemiology, to determine need for euthanasia or immediate booster vaccination followed by observation or strict quarantine.

(4) If booster is delayed beyond 96 hours, contact a veterinarian at Iowa HHS or IDALS.

(5) If vaccinated after 96 hours consider extending strict quarantine to 6 months.

(6) For livestock, if not boostered immediately, consult with the Iowa Department of Agriculture and Land Stewardship.

(7) None if Exposing animal successfully completes a 10-day confinement period. If not, the exposed animal should be observed for 45 days.

(8) None if Exposing animal successfully completes a 10-day confinement period. If not, the exposed animal should be observed for 45 days. If booster delayed may consider increasing the observation period for the Exposed animal, taking into consideration factors such as the severity of exposure, the length of delay in booster vaccination, current health status, and local rabies epidemiology.

(9) None if Exposing animal successfully completes a 10-day confinement period. If not, the Exposed animal should be placed in strict quarantine for 4 (dogs and cats) or 6 (ferrets) months. If vaccinated after 96 hours can consider extending strict quarantine to 6 months for dogs and cats.

(10) **Case-by-case** basis. If there is a high concern that a rabies exposure occurred, the guidelines outlined here can be applied.

(11) Low-risk animals are those that almost never carry rabies when they are demonstrating normal behavior. These include small rodents, squirrels, opossum, and lagomorphs (rabbits).

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Bat Exclusion/Mitigation for Buildings

While Iowa and federal laws protect bats, an exception exists for bats in human-occupied dwellings. Under **Iowa Code § 481A.42**, any bat except the Indiana bat found within an occupied building is considered unprotected and may be removed. However, several bat species in Iowa are federally protected.

Complicating these interactions, bats can be difficult to identify without proper training. There are **nine species of bats in Iowa**, three of which are federally protected (northern long-eared bat, tri-colored bat and Indiana bat). While big brown bats and little brown bats are the two most likely bat species to be found in an occupied dwelling, any identification of a bat species should be confirmed by an expert. Hazing, removal or exclusion during improper times of year (which could result in death from exposure or separating pups from nursing females) is illegal and may lead to fines or other penalties.

Exclusion of bats is the best long-term solution for keeping bats out of houses. If bats are using space in a house, one-way exclusion devices will allow bats to leave but not get back in. Once bats are out of the dwelling, any possible entry points should be permanently sealed. Iowa DNR guidance emphasizes that exclusion should only occur after all bats have emerged at dusk, avoiding maternity season (May 15-July 31) to prevent orphaning young. Exclusion or sealing of roosts during pup-rearing season may constitute an illegal "take" under both state and federal law.

Additionally, steps taken to deter or remove bats during hibernation (November-March, depending on temperatures) may increase bat activity in unwanted places (e.g., waking hibernating bats in an attic with noise and light may force them to seek more secluded shelter in the other areas of the house, resulting in more opportunities for them to come into contact with people). Waiting to exclude bats until nighttime temperatures are high enough for bats to be active and leave the dwelling (evening temperatures greater than 50°F) will ensure no bats are trapped inside. If based on the time of year or outdoor temperatures, complete exclusion is not possible or practical, sealing access points between an attic and living area can temporarily protect people until the bats leave in spring or late summer.

If a large number of bats are present, contact local **Iowa DNR Wildlife Management Staff**, a licensed **Nuisance Wildlife Control Operator (NWCO)** or **Wildlife Rehabilitator** licensed by Iowa DNR. These professionals can accurately identify species, recommend proper exclusion timing, and ensure all actions comply with legal requirements.

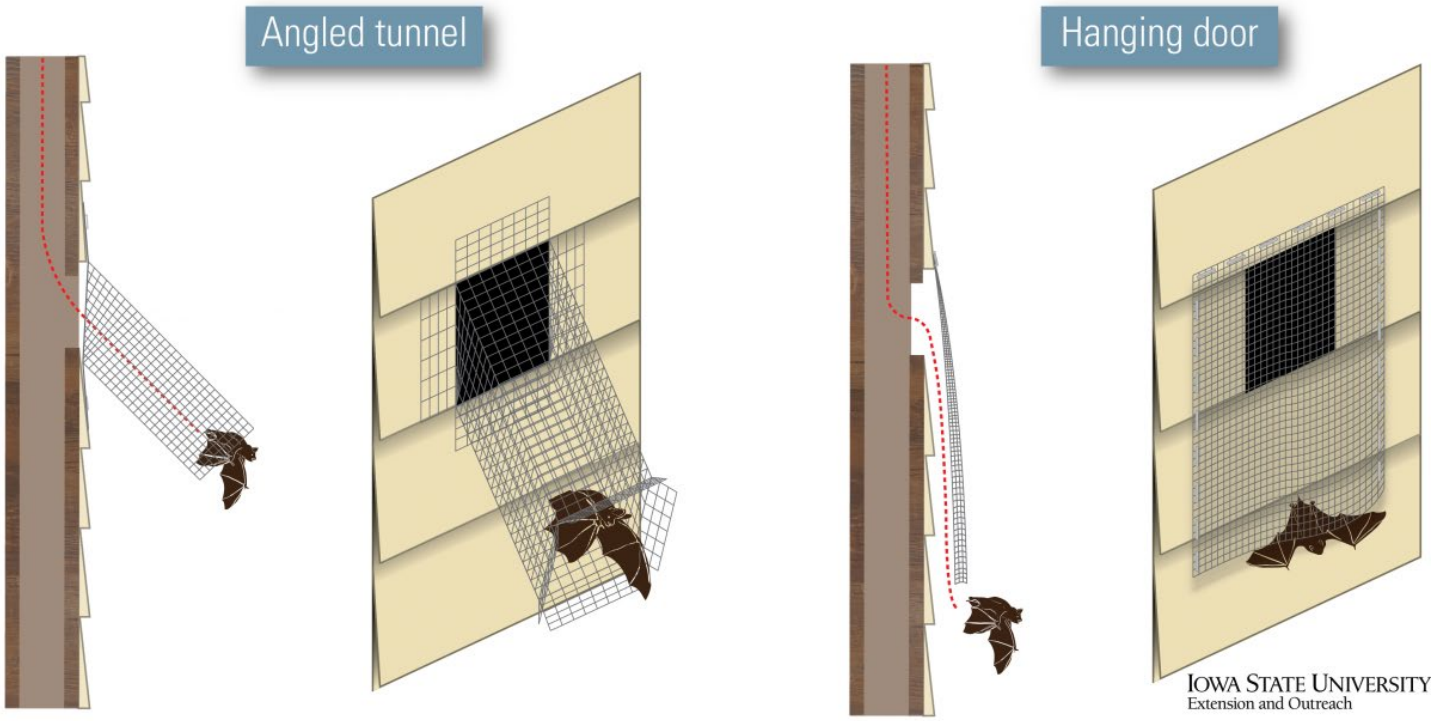
In practical terms, for a homeowner in Iowa, this means that if a single bat is found inside the residence, the individual should consult the Iowa HHS *Frequently Asked Questions about Bats and Rabies* guidance (available in both **English** and **Spanish**). If multiple bats are discovered, or if there is reason to believe that a bat (or bats) have taken up residence within the home, it is best to contact one of the three entities referenced above for appropriate guidance.



Additional information on bat mitigation for Nuisance Wildlife Control Operators is available in the **DNR NWCO Guidebook**.

Example of a Bat Exclusion Device:

Hanging half-inch polypropylene bird netting (used to protect fruit trees) during the day where bats exit allows emergence but prevents reentry. A 2-foot strip of netting can be fastened with duct tape or staples several inches above the exit opening and extended about a foot on either side and below.



Iowa State Extension and Outreach has created a complete guide on how to exclude bats from human spaces: **Bats: Damage Management | Natural Resources**.

Euthanasia of Free-Roaming Animals

Gunshots may be used to humanely dispatch free-ranging, captured or confined wildlife when other options are impractical and rabies testing is required. A shot to the **chest (heart)** or **upper neck** is acceptable in these situations and preserves the brain for diagnostic testing.

These methods usually result in humane killing rather than immediate euthanasia and may not render instant unconsciousness, so they require proper training and judgment. Firearm use must always be carefully evaluated for public safety, especially in urban or suburban areas where discharge may not be appropriate.

This guidance is based on current **AVMA Guidelines for the Euthanasia of Animals**.



A gunshot to the head will **compromise the ability to perform rabies testing**. If the goal of euthanizing an animal is to complete rabies testing, do not damage the animal's head.

Frequently asked Questions

Q1: Can an animal be vaccinated for rabies every two years and the health certificate for that animal reflect a two-year vaccination cycle?

No. USDA licensed rabies vaccines are approved only for one year or three-year schedules. No USDA licensed vaccine is validated for a two-year interval, so a two-year schedule is not compliant for health certificates. This is based on manufacturer guidelines.

Q2: If the owner of a dog that bites a person wants to euthanize their dog instead of undergoing a 10-day observation/confinement, is this allowed?

Owners may choose euthanasia, and local authorities may permit it, but euthanasia alone does not rule out rabies. The only definitive ways to rule out rabies after a bite are:

(1) Successful completion of a 10-day observation/confinement period, **or**

(2) Laboratory testing of the animal for rabies. If the animal will not undergo observation/confinement, testing is the only way to rule out rabies risk.

Q3: If the owner wants to euthanize an animal that may have exposed a person to rabies before completing an observation/confinement period, but does not want to submit the animal for rabies testing, is a veterinarian required by law to test the animal?

The authority for rabies enforcement falls at the local level (*see list of statewide contacts under "Animal Confinement" within the "Veterinarians" section of the* ***Iowa HHS Rabies webpage***).

If the local authority does not mandate the animal be tested, Iowa law does not require veterinarians to submit animals for rabies testing. Standard practice is to offer testing and to educate the owner about the risks and consequences. If the owner declines testing after being informed, the veterinarian must document the discussion and the owner's refusal in the medical record. Veterinarians may also remind owners that under Iowa Code §351.28 they could be liable for damages, including the cost of post-exposure prophylaxis (PEP), if rabies risk is not definitively ruled out.

Q4: Should I accept a history of rabies vaccination without written evidence of past vaccination?

No. Record the owner's statement in the medical record but require written documentation of prior rabies vaccination for any legal or regulatory purpose, including issuance of health certificates.

Q5: My client is a few days late on the three-year rabies booster for their dog. Can I still make the booster good for three years?

No. In Iowa, if a three-year booster is given after the scheduled due date (even by one day), the booster is valid for one year only, per vaccine manufacturer guidance. If the next booster is given on or before that one-year anniversary, the animal may return to the three-year schedule.

Q6: If an animal is up-to-date on their rabies vaccination and (bites) a person, should that animal undergo an observation/confinement period or testing if the animal dies?

Yes. Vaccination status does not change the required methods to rule out rabies.

For dogs, cats and ferrets the only definitive options are a 10-day observation/confinement period or laboratory testing if observation/confinement is not possible. For other species, consult the Iowa Department of Health and Human Services and the Iowa Department of Agriculture and Land Stewardship for guidance.

Q7: When should a puppy first get vaccinated for rabies in Iowa?

Do not confuse the six-month language in Iowa Code with the earliest vaccination age. Depending on the vaccine, manufacturers may list vaccination at 3 months or 12 weeks of age. Follow the vaccine manufacturer's guidelines for the correct minimum age to vaccinate.

Q8: Can contact with a dead animal result in a rabies infection for a pet or person?

Carcasses of rabid animals can sometimes contain live virus. Survival of the virus depends on temperature and environmental conditions. In warm weather the virus may die within hours, while it can persist for weeks or months in frozen carcasses. Drying and sunlight quickly inactivate the virus, so dried saliva or a thoroughly dried carcass would not contain live rabies virus.

Q9: If anyone at my veterinary clinic who was previously vaccinated against rabies is then exposed to rabies, do they need post-exposure prophylaxis?

Yes. Completing pre-exposure prophylaxis does not eliminate the need for PEP. Pre-exposure vaccination reduces the number of vaccine doses required and removes the need for rabies RIG (immune globulin). If you completed a pre-exposure series in the past but now require post-exposure prophylaxis because of a recent exposure, advocate for yourself that you do not also need a dose of RIG (immune globulin).

Q10: How often should veterinary clinic staff who were previously vaccinated against rabies have their titer checked?

See the **titer section** for complete details but overall, there is no longer a recommendation to check titers every two years for those working in a veterinary clinic servicing domestic animals.

Appendix A

On-Demand Training for Local Public Health Agencies

Iowa HHS created an on-demand rabies training for local public health partners within the Public Health Academy of Iowa (PHAI). The course equips local public health professionals with the knowledge needed to support community awareness, guide exposure response (including PEP recommendations) and reduce the public health impact of rabies.

Enroll in on-demand rabies training

Once you are in Workday:

1. Click on the “Learning” app
2. Click “Discover”
3. Click “Browse Learning”
4. Search “rabies”

Note—if you do not already have an account, you need to first create an account before accessing the training. To create an account, visit **External Workday Learning Registration**.

- Click here for additional information on **How to Create a Workday Learning Account**.
- Link to login to Workday in the future after creating an account: **Workday State of Iowa - Sign In to Workday**.

Additional resources and information on DAS website:
State of Iowa External Learning | Iowa Department of Administrative Services

Appendix B

Guidance for Iowa Local Rabies Authorities on Rabies Control and Animal Management

This section provides best practices for local authorities responsible for rabies control, animal management and enforcement. Iowa Code establishes statewide minimum requirements but delegates operational authority to local rabies authorities.

Please note, other than what is dictated in Iowa Code §351, **the following are suggested best practices and not mandates**. Localities are free to implement rabies rules at their discretion.

1. Rabies Vaccination Program Best Practices

1.1 Policy Standards

- Establish a minimum vaccination age of 3–4 months for dogs. Iowa Code §351.33 mandates vaccination by 6 months of age, but vaccination can and should occur before this. Based on local circumstances, consider extending requirements to include cats.
- Require revaccination according to vaccine manufacturer label and Iowa Code.
- Require an official rabies certificate for licensing, reclaim, and enforcement actions.

1.2 Operational Practices

- Link dog licensing to proof of current rabies vaccination.
- Authorize animal control officials (ACOs) to request proof of vaccination during investigations.
- Maintain a centralized database of vaccination records, licensing, and incident history.

2. Microchipping Best Practices

2.1 Policy Recommendations

- Encourage universal microchipping of dogs and cats.
- Require microchipping before release from impound, after a bite incident or upon dangerous/vicious designation.

2.2 Operational Standards

- Require scanning of all incoming animals, bite suspects and animals entering confinement.
- Register microchips with at least one major database.
- Record microchip numbers in county records and on rabies certificates.

3. Ten Day Rabies Confinement Procedures

3.1 When Confinement Is Required

- Local boards of health or their designees issue formal confinement orders.

3.2 Confinement Locations

- **Home Confinement:** Appropriate when the animal is owned, healthy, identifiable and the owner is cooperative.

- **Facility Confinement:** Required when the animal is stray, the owner is noncompliant or public safety concerns exist. Facilities may include county shelters, humane societies or veterinary clinics.

3.3 Confinement Order Standards

A written confinement order should include:

- Animal and owner identification
- Reason for confinement
- Start and end dates and times
- Location and conditions of confinement
- Prohibition on transfer or euthanasia during confinement without notification
- Consequences for noncompliance

3.4 Monitoring Requirements

- Conduct an initial health check at the start of confinement.
- Conduct a final health check on day 10 to confirm the animal is alive and healthy.
- Consider using phone or text check-ins supplemented by spot visits when appropriate.

4. Handling Repeat Offenders and Dangerous Dogs

4.1 Graduated Enforcement Model

- **First Bite:** Mandatory confinement, vaccination verification, microchipping and owner education.
- **Second Bite or Serious First Bite:** Dangerous dog designation with requirements such as secure enclosure, muzzle use, microchipping and proof of vaccination.
- **Third Bite or Severe Mauling:** Consider vicious dog designation, strict confinement or court-ordered euthanasia.

4.2 Recordkeeping

- Maintain centralized records linking animals, owners, microchips, and incident history.
- Share dangerous/vicious designations with neighboring jurisdictions when animals relocate.

5. Verifying Rabies Vaccination Status

5.1 Acceptable Proof

- Official rabies vaccination certificate with animal description, vaccination date, product information and veterinarian signature.
- Verified rabies tag numbers or licensing database entries.

5.2 Verification Workflow

- Request documentation from the owner.
- Contact the veterinarian or clinic to confirm vaccination details.
- Check county licensing records.
- Scan for microchip and use registration data to identify prior veterinary providers.
- Treat animals as unvaccinated if status cannot be verified.

Appendix C

Checklist for Law Enforcement Officers Responding to Animal Bites/Attacks

Immediate actions (on scene)

- ❑ **Ensure safety:** Separate people from the animal; if needed, provide first aid and advise immediate medical evaluation for possible PEP.
- ❑ **Secure or locate animal:** Capture only if safe; do **not** handle wildlife with bare hands.
- ❑ **Confine or dispatch biting animal:** For owned animals, initiate a confinement period. For wildlife, the head must be preserved, therefore chest (heart) or neck (vertebrae/spinal cord) gunshots may be used. Human health and ruling out the risk of rabies is the top priority.

Key facts to collect (record on incident form)

- ❑ **Victim:** Name; phone; address; date/time of exposure; wound description; care sought.
- ❑ **Animal:** Species; color/markings; owner name/contact; vaccination proof (date, vaccine type); microchip/license; current location.
- ❑ **Exposure details:** Provoked vs unprovoked; bite/scratch/mucous membrane; saliva fresh/wet or dried; animal behavior.

Specimen submission & testing (when required)

- ❑ **When to test:** Confinement impossible; animal dies or becomes ill during observation; high-risk species (bats, skunks, foxes, raccoons).
- ❑ **Specimen handling:** Submit whole carcass or entire head; refrigerate and submit promptly.
- ❑ **Iowa labs:** confirm local procedures with State Hygienic Laboratory and ISU Veterinary Diagnostic Lab for weight limits, fees, and after-hours testing.

Human exposure & rabies PEP coordination

- ❑ **Provide contact information:** Provide the person bitten by the animal with contact information for the local public health agency and/or the Iowa Department of Health and Human Services (Iowa HHS). Iowa HHS is also available via email: rabies@hhs.iowa.gov.

Bat guidance

- ❑ **Treat bats as high risk** when skin-to-skin contact occurred; capture and submit whole bat when possible; do not handle bats with bare hands.
- ❑ **Provide information on mitigating bats from entering buildings.** ISU Extension has a good, simple resource for a starting place: ISU Bats: Damage Management.

Appendix D

Client Handout Explaining 10-day Confinement

Your Pet's 10-Day Confinement

Why is my pet confined for 10 days?

When a cat or dog bites or attacks a person or another animal, there is a very small chance it could have rabies, a deadly virus. Iowa law requires a 10-day confinement so your pet can be watched closely for signs of illness (Iowa Code §351.39).

If your pet stays healthy for the full 10 days, it did not have rabies at the time of the bite or attack. If your pet becomes sick during this confinement period, it may have rabies, and anyone exposed during the original incident may need prompt medical treatment to prevent death. Even though the risk is low, this confinement period is an **important and mandatory safeguard**.

More information on rabies can be found on the following website: **https://hhs.iowa.gov/health-prevention/animal-safety-and-disease-prevention/rabies.**

What happens during the next 10 days?

Your dog, cat or ferret will be kept at a location chosen by your local rabies authority (Iowa Code §351.36). During confinement you must follow any instructions they give. Your pet will be observed for signs such as worsening illness, loss of appetite, unusual behavior or increased aggression. If your pet shows these signs, it will be evaluated and, if needed, tested to see if it could have spread rabies.

What happens if I don't follow rabies instructions?

Not following the local rabies authority's rules can lead to your pet being impounded (Iowa Code §351.39) and possible misdemeanor charges (Iowa Code §351.43). Under Iowa law, a dog owner can also be held liable for injuries caused by their dog (Iowa Code §351.28). This could include costs for post-exposure rabies treatment if the proper steps are not taken to rule out rabies. Completing the 10-day confinement is the safest and simplest way to protect everyone.

How can I find the contact information for my local rabies authority?

Go to the Iowa Department of Health and Human Services **rabies webpage**. Click "Veterinarians," then select "Animal Confinement." Then open the *Statewide Points of Contact for Animal Rabies Quarantine Enforcement* list to find contact information for your local rabies authority.



Local authorities may adapt this text to create a version for their jurisdiction that adds local ordinances and specific contact or follow-up instructions.

If no local version is produced, an Iowa HHS printable handout of this text is available at **https://hhs.iowa.gov/rabies** under "Veterinarians" and "Animal Confinement."

Appendix E

Bats of Iowa Identification Guide

Key to the Bats of Iowa

Written by Russ Benedict, Central College, Pella, Iowa.

Forelimbs modified for flight; digits of forelimb, which support flight membrane, longer than forearm; incisors on opposites sides of upper jaw separated by emargination of palate → **Order Chiroptera**

1a. Tail extending past posterior border of tail membrane so that at least 20 % of the length of the tail is free; anterior border of ear with six to eight fleshy protrusions; tops of lower incisors bi-lobed → **Order Chiroptera, Family Molossidae (**free-tailed bats)

1b. Tail not extending or just barely extending beyond posterior border of tail membrane; anterior border of ear lacking fleshy protrusions; tops of lower incisors tri-lobed → **Order Chiroptera, Family Vespertilionidae (**evening bats)

Key to Family Vespertilionidae – evening bats

1a. Dorsal surface of tail membrane possessing hair for at least 25% of its length ➡ 2

1b. Dorsal surface of tail membrane naked or possessing only a few hair where it meets body ➡ 5

2a. Dorsal surface of tail membrane covered with dense coat of hair over its whole surface ➡ 3

2b. Dorsal surface of tail membrane covered with thin or moderate coat of hair for about $^1/_3$ to $^1/_2$ its length ➡ 4

3a. Dorsal color reddish-brown or orange; forearm length < 45 mm → *Lasiurus borealis*, eastern red bat

3b. Dorsal color frosted – gray or dark brown hairs tipped with white; forearm length > 47 mm → *Lasiurus (Aeorestes) cinereus*, hoary bat

4a. Dorsal color medium to dark gray, tipped with white; forearm > 37 mm (but < 45 mm); hind feet typical for its body size → *Lasionycteris noctivagans*, silver-haired bat

4b. Dorsal color gold or tan; reddish forearm contrasts strongly with blackish wings; forearm < 37 mm; hind feet large for its body size → *Perimyotis subflavus*, tricolored bat / eastern pipistrelle

5a. Size large; total length > 110 mm; forearm > 43 mm; skull length > 18 mm; snout inflated on sides giving "punched in the nose" appearance → *Eptesicus fuscus*, big brown bat

5b. Size small; total length < 110 mm; forearm < 43 mm; skull length < 18 mm; tragus and nose variable ➡ 6

6a. Tragus short and blunt, less than 1/3 the height of the ear; dorsal surface dark brown; has "burnt tooth" smell in life; incisors 1/3; snout somewhat inflated on sides, giving bat "punched in the nose" appearance → *Nycticeius humeralis*, evening bat

6b. Tragus long and pointed, at least 1/3 the height of the ear; dorsal surface typically light to medium brown; incisors 2/3 ➡ 7

7a. Wing membrane attaches to ankle so that hind foot projects completely free from tail Membrane; noticeable notch present on underside of each claw on hind foot; forearm 40 mm or greater → *Myotis griscesens*, gray bat (not officially recorded from Iowa)

7b. On outside edge of hind foot, wing membrane attaches to side of foot, roughly where outside toe meets "sole" of foot; hind foot not projecting free from tail membrane (see illustration); underside of claws not notched; forearm 41 mm or less ➡ 8

8a. Ears > 16.5 mm in height; forearm < 37 mm; tragus very long and sword-shaped; both inner and outer edge of tragus straight, meeting to form a point; dorsal and ventral fur often with a slight yellowish cast → *Myotis septentrionalis*, northern long-eared myotis

8b. Ears < 16.5 mm; forearm > 36.5 mm; tragus not as long and not sword-shaped; inner edge of tragus straight, outer edge curved ➡ 9

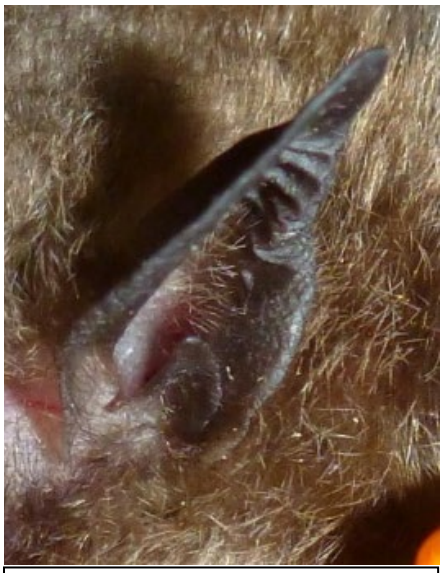
9a. Hairs on toes of hind feet numerous and long, projecting beyond toes; hind feet large, usually 8.5 – 10 mm; calcar usually not keeled; dorsal fur usually somewhat glossy; dorsal fur usually noticeably darker than ventral fur → *Myotis lucifugus*, little brown bat

9b. Hairs on toes of hind feet few in number and short, not projecting beyond toes; hind feet small, usually 7.2 – 8.6 mm; calcar noticeably keeled; dorsal fur dull in appearance; dorsal fur similar to or only slightly darker than ventral fur → *Myotis sodalis*, Indiana bat

Key to Family Molossidae – free-tailed bats

1a. Ears meet and fuse on top of head; four total lower incisors; forearm > 54 mm → *Nyctinomops macrotis*, big free-tailed bat

1b. Ears not meeting on top of head; six total lower incisors; forearm < 46 mm → *Tadarida brasiliensis*, Mexican free-tailed bat



Above:
Tragus of *Myotis sodalis* or *M. lucifugus*, with straight inner edge and curved outer edge.



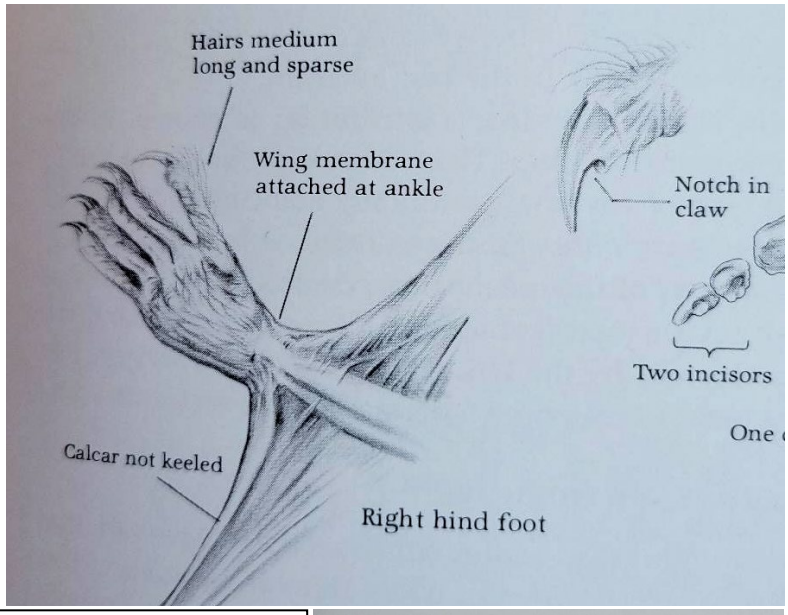
Above: Hind foot of *Myotis sodalis* shows keeled calcar and shows wing membrane attaching to base of outer toe (compare to Gray Bat wing membrane drawing below).



Above:
Ear of *Myotis septentrionalis* showing tragus with two straight edges meeting in a sharp point.



Above: Photo of *Nycticeius humeralis* shows short, blunt tragus and "punched in the nose" look of snout.



Above, right: ID of *Myotis grisescens* shows notch on underside of claws of foot, and wing membrane attaching to ankle, so whole foot projects out of wing membrane.
Right: Drawing shows more typical wing attachment at base of toes. Illustrations from *Wild Mammals of Missouri* by Schwartz and Schwartz.

