

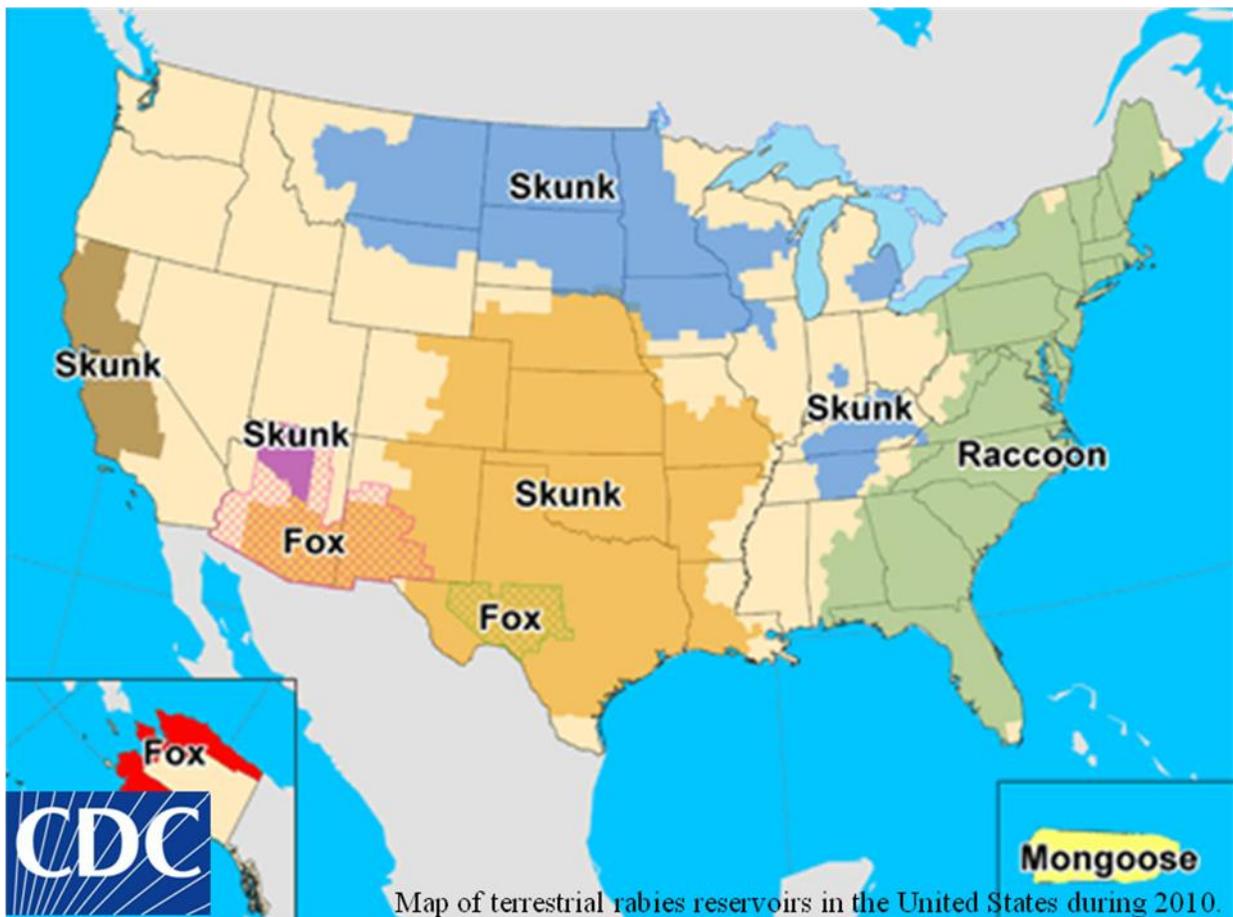
Rabies in Indiana

An Overview of Handling the Disease in the Hoosier State

A Cooperative Effort of the IVMA and the Indiana State Board of Animal Health

Rabies is a disease that continues to be a public health concern, for both animals and people.

This course provides an overview of the disease, how the virus spreads and prevention, along with Indiana's laws and policies. Protocols for prevention and handling potential exposures vary from state to state; therefore, some of the information presented in this course may not apply to cases outside Indiana.



RABIES: THE DISEASE

Rabies is a viral disease that affects the central nervous system of mammals and has a high fatality rate. Once clinical signs develop survival rate is low. The neurotropic virus in the genus *Lyssavirus*, family *Rhabdoviridae* causes rabies.

All mammals are susceptible to rabies, but only a few serve as reservoir hosts for the virus. Variants, or strains, of the rabies virus reside in specific animal hosts, establishing a reservoir population. The host species provides the name for the variant. For example: If a skunk variant affects a dog, the canine has skunk rabies, not canine rabies. While a variant is maintained in a specific population, rabies can become established in other species as well.

The only recognized reservoirs are:

- canine (dogs, foxes, coyotes, wolves),
- mustelidae (skunks),
- viverridae (mongooses),
- procyonidae (raccoons) and
- the order chiropter (bats).

Two species highly unlikely to be infected with rabies are lagomorphs and rodents. Potential exposures by those species need to be evaluated on a case-by-case basis. However, in the absence of a very high environmental virus load, those species are unlikely to carry infection.

Rabies has two epidemiologic cycles, **urban** (maintained in the dog) and **sylvatic** (wildlife). The urban cycle is common in places with large populations of unvaccinated and stray dogs, such as in Africa, Asia, the Middle East and Latin America. This cycle is maintained in canine populations, but can spread to canine wildlife such as foxes and coyotes. The sylvatic cycle is predominant in Europe and North America. (The United States was declared free of canine strain in 2009.) The species responsible depends on the environment, the behavior of the host, ecology and the species involved. More than one species can help keep a reservoir maintained in a country. Bats maintain a large reservoir in the Americas, but that strain can also be found in skunks and other mammals. Raccoons have their own strain, which can also be found in skunks, dogs and cats.

The virus is **transmitted** primarily by the bite of an infected animal, although rabies has been shown to be transmitted through organ transplants and via infected saliva contaminating an open wound. Not all bites transmit rabies; however, discerning the presence of infection at the time of the exposure is impossible. The virus does not survive for long periods in the environment, being susceptible to heat and cold, as well as most disinfectants. High and low pH levels inactivate the virus.

The **incubation** period varies by species. Generally, dogs and cats present signs within 10 days, but can take up to 6 months. Livestock may take up to 25 days to show signs of rabies. Wildlife, including bats, may incubate the virus up to 6 months or longer. Many individuals believe that wildlife can remain symptomatic for longer periods of time.

Clinical signs are often non-specific, including fearfulness, restlessness, anorexia, increased appetite, vomiting diarrhea, fever, hyper-reactivity and hyper-salivation. These eventually lead to one of two clinical presentations: paralytic (or “dumb”) form or the furious form.

The **paralytic form** of rabies is characterized by paralyzed throat and masseter muscles, inability to swallow and profuse salivation. Laryngeal paralysis can cause vocalization along with ataxia and incoordination. Biting is uncommon in this phase and death occurs within 2 days to 6 days after onset because of respiratory failure. The **furious form** is associated with infection of the limbic system and is the common form in dogs and cats. Furious rabies appears as restlessness, wandering, howling, drooling and attacks on other animals. Wild animals lose their fear of humans and nocturnal animals will be visible during the day. Convulsions and seizures will precede death, which will generally occur 4 days to 8 days after onset of clinical signs.

Once clinical signs have occurred, treatment has not been successful in many cases. In human cases, four people have survived after aggressive treatment with antivirals and induced comas; this regimen is not very successful. Treatment at the time of exposure with post-exposure injections is the best way to stop rabies infection.

Prevention is truly the key to Indiana's public health strategy. Vaccination of susceptible species, including dogs, cats and ferrets, is at the foundation of preventing disease spread. Likewise, avoidance of infected animals, along with post-exposure treatment of people exposed to rabies-positive animals, is an important strategy. Pre-exposure vaccination of humans working with susceptible animals on a regular basis is recommended.

VACCINATION: ANIMALS

Indiana law requires all dogs, cats, and ferrets 3 months of age and older be vaccinated against rabies. To be recognized as valid, the vaccination must be administered by a licensed and accredited veterinarian.

Rabies vaccination of a dog, cat, and ferret should be maintained by ongoing **revaccination** of the animal as follows:

- All commercially available rabies vaccines require a **booster** 1 year after the initial vaccination.
- Ferrets should be revaccinated within 12 months of the prior vaccination, as only a 1-year vaccine is approved for use.
- Dogs and cats vaccinated with a rabies vaccine with a label recommending annual boosters should be revaccinated within 12 months of the prior vaccination.
- Dogs and cats that are vaccinated with a rabies vaccine with a label recommendation of a booster 1 year later and triennially thereafter should be revaccinated within 12 months of the first vaccination and then revaccinated within 36 months of each vaccination thereafter.

Veterinarians administering the rabies vaccine must complete a **vaccination certificate** or computerized record, in triplicate, on each animal vaccinated for rabies. Records should include the following information:

- The name and address of the animal's owner.
- The species, sex, and age of the animal vaccinated.

- The date the animal was vaccinated.
- The product name and lot or serial number of the vaccine used.
- The date the animal must be revaccinated.
- The number of the tag issued.
- The name of the veterinarian completing the vaccination and his/her Indiana veterinary license number.

The rabies vaccination certificate should be distributed as follows:

- One copy of the certificate or computerized record shall be given to the owner or custodian of the animal being vaccinated.
- One copy of the certificate or computerized record shall be retained by the veterinarian vaccinating such animal covering the period of immunization.
- Some local jurisdictions require one copy of the certificate or computerized record be forwarded to the county health officer within 30 days of the vaccination. Practitioners should verify local requirements. Likewise, *if requested*, documentation should be forwarded at the request of the State Veterinarian.

A veterinarian who vaccinates a dog, cat, or ferret should furnish to the owner or custodian of the animal a rabies vaccination identification tag that contains the following:

- The veterinarian's or clinic's name and telephone number.
- A unique identification number.

The owner or custodian of an animal vaccinated for rabies should keep a copy of the certificate and tag required to be issued until the animal must be revaccinated.

For pets **traveling** across state lines, contact the state-of-destination for rabies vaccination requirements as well as the need for a certificate of veterinary inspection. Pets traveling interstate should have vaccination status noted on the certificate for veterinary inspection.

Serologic titers as a substitute for vaccination

Titers do not directly correlate with protection because other immunologic factors also play a role in preventing rabies, and the ability to measure and interpret those other factors are not well developed. Therefore, evidence of circulating rabies virus antibodies should not be used as a substitute for current vaccination in managing rabies exposures or determining the need for booster vaccinations in animals. Titers are used to move animals into rabies-free areas such as Hawaii, Australia and Europe.

Indiana State Board of Animal Health does not provide for a titer to substitute for vaccination. Medical exemptions are not granted in the state of Indiana.

Vaccinating livestock

While rabies vaccines are available for many livestock species, in Indiana, livestock are not required to be vaccinated. Exhibition livestock are recommended to be vaccinated. Some states, such as New York, require exhibition livestock to be vaccinated for rabies.

Vaccinating other species (wildlife)

Pet owners should be advised not to keep wildlife as pets. Indiana Department of Natural Resources issues a wild animal possession permit for wildlife kept as pets.

Vaccination of wild species is not recognized in Indiana. No vaccine product is currently labeled for use in wildlife species, including crosses like coy-dogs and wolf/wolf-hybrids. Some veterinarians, at their client's request, may choose to administer vaccine to owned wild species, such as raccoons and skunks. However, the validity of the vaccine will not be recognized in a bite event. Therefore, practitioners should advise their clients that if the animal bites a human, the exotic pet would be subject to euthanization for testing.

Some U.S. regions, primarily Eastern Seaboard states, vaccinate free-ranging populations of raccoons and other high-risk species to contain spread of the disease in the wild. Coordinated, regional vaccination programs usually involve inoculating through an oral rabies vaccine distributed in a bait. These vaccines are not available for use in wild species pets or by private practitioners.

A raccoon-strain rabies baiting program has been ongoing for several years, reaching from the East Coast westward to Eastern Ohio, where wild raccoons are known to be infected.

VACCINATION: HUMANS

Pre-exposure vaccination should be offered to persons in high-risk groups, such as veterinarians, animal handlers, and certain laboratory workers. Pre-exposure vaccination does not eliminate the need for additional therapy after a rabies exposure, but can simplify treatment by eliminating the need for rabies immunoglobulin (RIG) and decreasing the number of doses of vaccine needed.

Pre-exposure prophylaxis protects persons whose post-exposure therapy is delayed and might provide protection to persons at risk for unapparent exposures to rabies. Pre-exposure vaccination can be given intramuscularly and consists of three injections, one injection on days 0, 7, and 21 or 28.

Veterinarians and their staff are generally classified as high-risk populations. All veterinary staff who handle animals should be pre-exposure vaccinated for rabies and should have a serum sample tested for rabies antibody every 2 years. Testing may be done more often than 2 years, with a booster given if the **titer** falls below 1:5 serum dilution by the RFFIT (radio fluorescent focus inhibition test). Another rabies titer test that is used in individuals traveling to rabies-free countries (animal and human) is FAVN (fluorescent antibody virus neutralization test).

BITE REPORTING

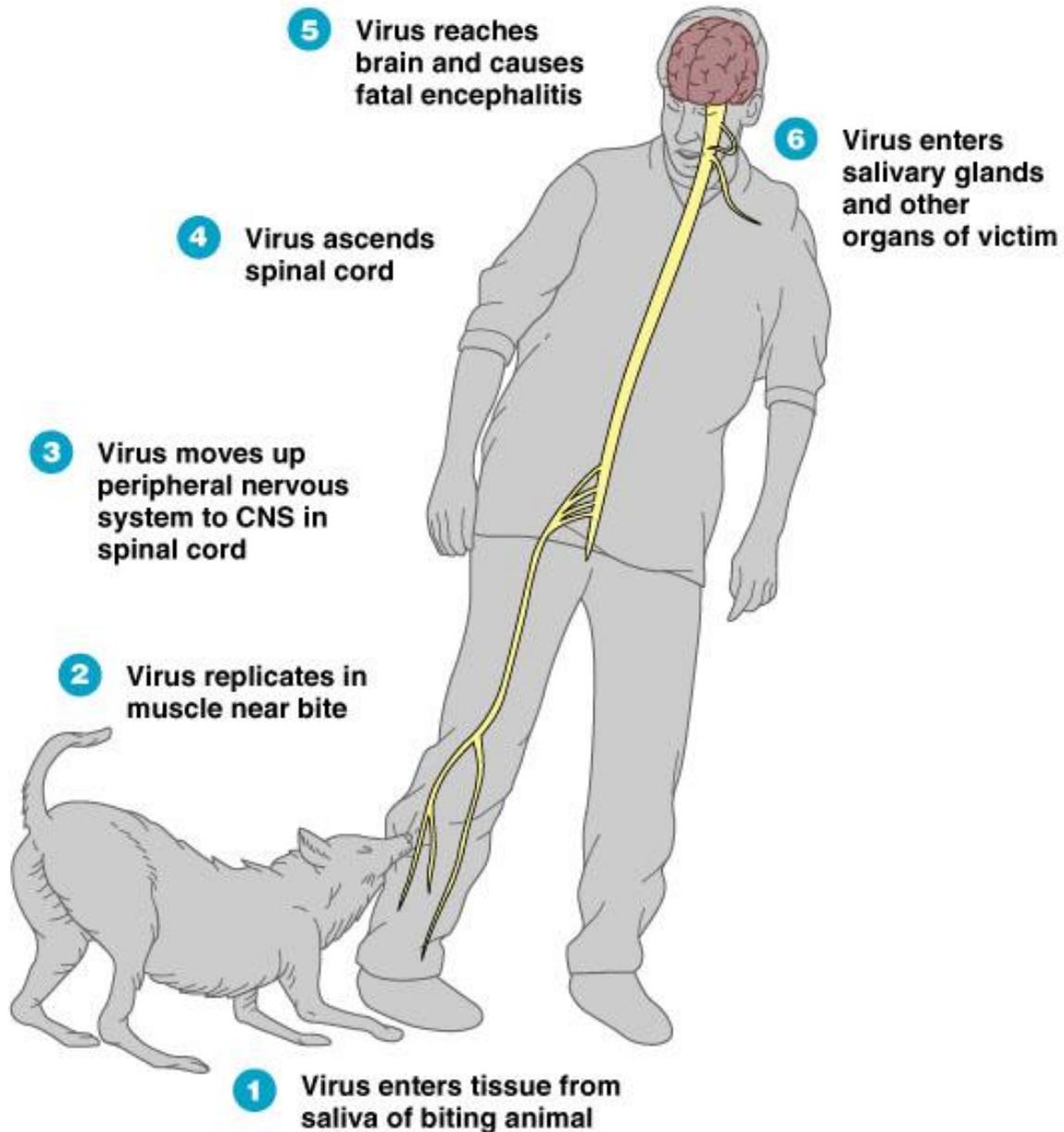
All animal bites, from domestic or wild animals, to a human must be reported to the local health department within 24 hours. If a physician provides care to the person who was bitten, the physician should report the animal bite. Some counties use animal control agencies for bite reporting and investigation.

When a dog, cat or ferret bites a person, the animal must be **confined and observed**. Specific rules relating to animal bites to people are under the jurisdiction of the local health department. The state does not identify where confinement or quarantine is done. Local ordinance or rule may specify places or circumstances of confinement.

Vaccinated pets: A vaccinated dog, cat or ferret must be confined and observed for 10 days. Confinement of the animal may be completed at home, an animal control agency, or other designated facility. The quarantine should be coordinated with the local health department or animal control agency to ensure all criteria are met.

Unvaccinated animals: Wild animals will be euthanized if they bite a person. Unvaccinated domestic animals may be euthanized and tested for rabies. If the owner is unwilling to have this done, the animal must be placed in strict isolation for 6 months. Rabies vaccine should be administered to the animal upon entry into isolation or 1 month before release.

For human bite cases, call Indiana State Department of Health (ISDH) at 317-233-7272.
For animal bite cases, call the State Board of Animal Health at 317-544-2400.



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RABIES TESTING

When to test

Only a potentially rabid animal that has had exposure contact with a human or pet animal to rabies should be tested. No test exists to determine if a live animal has rabies.

Samples needed for rabies testing

Euthanasia should be accomplished in such a way as to maintain the integrity of the brain, so that the laboratory staff can recognize the anatomical parts. For example: Do not shoot animals in the head, which could destroy the sample.

Rabies testing should be performed in accordance with the established national standardized protocol for rabies testing by a qualified laboratory. In Indiana, the only approved laboratory is at the Indiana State Health Department. Purdue Animal Disease and Diagnostic Laboratory (ADDL) can submit a sample for rabies testing when conducting a necropsy for cause of death. Private practitioners may submit samples directly to ISDH for testing.

Indiana State Health Department's rabies **submission guidelines** and form may be found on BOAH's website at: [www.in.gov/boah/files/Form_37763_fill-in10-09_\(2\).pdf](http://www.in.gov/boah/files/Form_37763_fill-in10-09_(2).pdf).

When submitting bats, the entire body of the bat needs to be submitted. Presence of the whole body will allow a specialist to identify the species of bat. For all other animals, only submit the head or brain (including brain stem) to the ISDH laboratory. To facilitate laboratory processing and prevent a delay in testing, any animal or animal specimen being submitted for testing should be stored and shipped under refrigeration, *not* frozen. Frozen samples will have to be thawed before testing can be done. In situations that do not allow for shipping and testing within 2 days (such as holiday weekends when the state laboratory is closed), samples may be temporarily frozen. Extended freezing can generate artifact in the sample, which may affect test results if frozen for long periods of time.

Chemical fixation of tissues should be avoided. Questions regarding testing of fixed tissues should be directed to the state rabies laboratory.

ISDH does not assess a fee for testing rabies tests; however, shipping costs are the responsibility of the owner or shipper. Next-day shipping is recommended.

Tests performed to diagnose rabies

The direct fluorescent antibody test (DFA) is most frequently used to diagnose rabies. This test requires brain tissue from animals suspected of being rabid and can only be performed post-mortem. This test has been thoroughly evaluated for more than 40 years, and is recognized as the most reliable of all the tests available for routine use. Other tests for diagnosis and research, such as electron microscopy (EM), histologic examination, immunohistochemistry (IHC), RT-PCR, and isolation in-cell culture are useful tools for studying the virus structure, histopathology, molecular typing, and virulence of rabies viruses.

POST-EXPOSURE TREATMENT

ANIMAL BITE TO A HUMAN

Owned Dogs, Cats, and Ferrets

Rabies virus may be excreted in the saliva of infected dogs, cats, and ferrets during illness and/or for only a few days before illness or death. A healthy dog, cat, or ferret that bites a person should be confined and observed daily for 10 days. Administration of rabies vaccine to the animal is not recommended during the observation period to avoid confusing signs of rabies with possible side effects of vaccination. Animals in confinement should be evaluated by a veterinarian at the first sign of illness. Any illness in the animal should be reported immediately to the local health department. If signs suggestive of rabies develop, the animal should be euthanized and the head prepared and shipped for testing.

Unowned animals and wildlife, stray or unwanted dogs, cats, or ferrets that bite a person may be euthanized immediately and the head submitted for rabies examination. If asked, advise the person reporting the bite to try to collect the animal only if it can be done safely, without further risk of injury to a human. Animals, dead or alive, should not be handled with bare hands.

Other Animals

Other biting animals that might have exposed a person to rabies should be reported immediately to the local health department. Management protocols for animals other than dogs, cats, and ferrets will depend on the species, the circumstances of the bite, epidemiology of rabies in the area, the biting animal's history, current health status, and the animal's potential for exposure to rabies. Euthanasia and testing may be necessary, even for previously vaccinated animals.

POTENTIAL EXPOSURE OF ANIMALS: VACCINATED ANIMALS

Animals exposed to a suspect or positive rabies animals must be handled in a specific manner, based on circumstances. Potential exposures are not limited to an animal-to-animal bite. Cases, such as an unvaccinated cat with mouth exposure to a bat, may warrant specific protective actions.

Dogs, Cats, and Ferrets

Vaccinated dogs, cats, and ferrets should be revaccinated immediately, kept under the owner's control, and observed for 45 days. Any illness in an isolated or confined animal should be reported immediately to the local health department. If signs suggestive of rabies develop, the animal may be euthanized and the head submitted for testing.

Livestock

Livestock exposed to a rabid animal and currently vaccinated with a USDA-approved vaccine should be revaccinated immediately and observed for 45 days.

Multiple rabid animals in a herd or herbivore-to-herbivore transmission are uncommon; therefore, a whole-herd restriction based on a single animal's exposure is usually not necessary. In the case of a herd-wide diagnosis, contact BOAH for further guidance.

Other Animals

Other mammals exposed to a rabid animal should be euthanized immediately. Contact Indiana State Health Department before submitting samples for testing; ISDH wants only animals with human or pet exposure. Animals maintained in USDA-licensed research facilities or accredited zoological parks should be evaluated on a case-by-case basis.

ANIMAL WITH EXPIRED RABIES VACCINATION

Dogs, Cats, and Ferrets

Unowned/unwanted dogs, cats, and ferrets exposed to a rabid animal should be euthanized and tested for rabies. If the owner is unwilling to have this done, the animal must be placed in strict isolation for 6 months. Rabies vaccine should be administered to the animal upon entry into isolation or 1 month before release. No USDA biologics are licensed for post-exposure prophylaxis of previously unvaccinated domestic animals, and evidence exists that the use of vaccine alone will not reliably prevent the disease in these animals.

Animals with expired vaccinations need to be evaluated on a case-by-case basis. BOAH should be consulted for additional guidance in these situations.

Livestock

Unvaccinated livestock should be euthanized immediately. If the animal is not euthanized, it should be kept under close observation and isolation for 6 months. Any illness in an animal under observation should be reported immediately to the local health department. If signs suggestive of rabies develop, the animal should be euthanized and the head submitted for testing only if a human exposure has occurred. Multiple rabid animals in a herd and herbivore-to-herbivore transmission are uncommon; therefore, restricting the rest of the herd if a single animal has been exposed to or infected by rabies is usually not necessary.

Other Animals

Other mammals exposed to a rabid animal should be euthanized immediately. Animals maintained in USDA-licensed research facilities or accredited zoological parks should be evaluated on a case-by-case basis.

INDIANA RABIES DATA

The chart below lists (as of December 2013) the number rabies-positive animals, by species, identified in Indiana since 1962. The last year in which a rabies case in that species occurred is noted.

SPECIES	LAST YEAR POSITIVE	NUMBER POSITIVE SINCE 1962
BAT	2013	>500
DOG	1989	182
CAT	1984	47
COW	1986	79
FOX	1990	99
GOAT	1967	1
GROUND HOG	1983	2
HORSE	2002	16
OPOSSUM	1968	1
PIG	1967	4
RACCOON	1979	4
SHEEP	1982	1
SKUNK	2004	824
HUMAN	2009	2

REFERENCES

CDC. *Human rabies prevention—United States, 2008. Recommendations of the Advisory Committee on Immunization Practices (ACIP)*. MMWR 2008;57(No. RR-3):1-28. Available at: www.cdc.gov/mmwr/preview/mmwrhtml/rr57e507a1.htm.

CDC. *Wildlife Reservoirs for Rabies*. Nov. 10, 2011. www.cdc.gov/rabies/exposure/animals/wildlife_reservoirs.html

Guidelines for Post-Exposure Rabies Treatment. 2010. Indiana State Department of Health, Indiana State Board of Animal Health. www.in.gov/boah/2337.htm

345 IAC 1-5-1 Rabies vaccination. Authority: IC 15-17-3-21. Affected: IC 15-17-3-13; IC 15-17-6

410 IAC 1-2.3-52 Animal bites; specific control measures. Authority: IC 16-19-3-4; IC 16-41-2-1. Affected: IC 15-17-6-11; IC 16-41-2; IC 16-41-9

The Center for Food Security and Public Health. Rabies information. <http://www.cfsph.iastate.edu/DiseaseInfo/disease.php?name=rabies>

ATTACHMENTS:

ISDH Rabies Specimen Request: [www.in.gov/boah/files/Form_37763_fill-in10-09_\(2\).pdf](http://www.in.gov/boah/files/Form_37763_fill-in10-09_(2).pdf)

ISDH Official Animal Bite Report: <https://forms.in.gov/Download.aspx?id=4758>

Rabies Treatment Algorithm (saved as pdf)

QUIZ

Please complete and submit to IVMA by one of the following methods:

- Fax: 317/974-0985
 - Scan and email to info@invma.org
 - Mail to: IVMA; 201 S. Capitol, #405; Indianapolis, IN, 46225
-
1. If a vaccinated dog, cat, or ferret bites a person, how long should the pet be quarantined?
 - a. No quarantine is required.
 - b. 10 days.
 - c. 45 days.
 - d. 6 months.

 2. If an unvaccinated dog, cat or ferret is exposed to a rabid animal, how long should the pet be quarantined?
 - a. No quarantine is required.
 - b. 10 days.
 - c. 45 days.
 - d. 6 months.

 3. ALL commercially available rabies vaccines require a booster one year after the initial vaccination.
 - a. True
 - b. False

 4. Which of the following is NOT a rabies reservoir species in the US?
 - a. Skunk
 - b. Opossum
 - c. Fox
 - d. Raccoon

 5. If you suspect that a dog or cat has had a rabies exposure, you should wait 10 days before you boost the vaccination.
 - a. True
 - b. False

 6. A 10-day quarantine is MANDATORY for dogs, cats, and ferrets that have bitten a person; rabies testing is only permitted if the animal is terminally ill or injured.
 - a. True
 - b. False

7. Animal bites to a human from domestic and wild animals should be reported to the local health department within _____ hours?
 - a. 5 hours
 - b. 48 hours
 - c. 12.5 hours
 - d. 24 hours

8. Rabies is _____ .
 - a. paramyxovirus
 - b. oox virus
 - c. Lyssavirus
 - d. Influenza

9. What species of animals should be vaccinated for rabies and at what age?
 - a. Cats, raccoons, bats that are 1-year-old
 - b. Dogs, foxes, skunks that are 6 months old
 - c. Dogs, cats and ferrets that are 3 months of age and older
 - d. Opossums, cats, dogs that are 3 months old

10. Indiana grants medical exemptions for rabies vaccinations.
 - a. True
 - b. False