An Overview

It is with a great deal of pleasure that we are able to bring to concerned individuals a guidebook to deal with handling people, animals and specimens with regards to animal bites and the risk of rabies. These situations bring up many questions and it is hoped that this book will provide answers for handling those involved. With the outbreak of rabies in raccoons in the East, skunks in the West and coyotes, dogs and foxes of Texas, Indiana can potentially become part of one of these epidemics. With the proper preparation and public education, it is hoped that the impact of such an epidemic will be less severe.

The Companion Animal Committee is composed of members of the Indiana Veterinary Medical Association (IVMA), Indiana State Board of Animal Health (BOAH), Indiana State Department of Health (ISDH), Indiana Association of Animal Control Personnel (IAACP), and Purdue University School of Veterinary Medicine (PUSVM)/Cooperative Extension. Through the efforts of these people and using guidelines published by other state involved in the outbreaks, it is hoped that this will remain an important item on your bookshelf which will be updated periodically as information and situations change. The book itself is in a three ring binder so pages can be added and removed easily.

The following outlines each section:

Section 1: Introduction - This includes an explanation for the manual and a simple diagram that explains how rabies is transmitted and spread through wildlife to other species.

Section 2: Telephone List - Here are important phone numbers regarding animal bite situations and sources of information. Notice there are blank lines to fill in local phone numbers of local agencies that handle many of these situations. Please put the appropriate numbers in these blanks for easy reference.

Section 3: Animal to Human Bite Procedures - This section explains about the handling of these situations and a little about the rabies virus and disease transmission. The last sheet is a flow chart to follow for identification of specific procedures to follow in various situations.

Section 4: Animal to Animal Bite Procedures - This section has a flow chart to handle both vaccinated and unvaccinated animals with regards to bite situations. Guidelines for quarantine at various levels and descriptions of facilities to be used at home are included.

Section 5: Submission of Samples - This section includes instructions for sending in head and brain samples as well as the ISDH submission form, which can be copied and used for each sample submitted.

Section 6: Maps and Directions to Laboratories - Included in this section is the map to the Rabies Laboratory at ISDH. Directions to the Diagnostic Laboratories at Purdue and in Southern Indiana are also here. They can submit the appropriate sample from animals being examined for other reasons or help remove a brain for tissue sampling.

Section 7: This section is vacant for a reason - In the face of an outbreak or epidemic, it will be necessary to institute special guidelines for emergency situations. Each book holder will be sent these new rules at the appropriate time to put in this section.

Section 8: Appendix - This contains the Indiana Administrative Code regarding the vaccination of animals and rabies control (BOAH), and the reporting and investigating of animal bites to humans (ISDH). The Compendium on Animal Rabies Control, which is incorporated as part of Indiana law, is included and will be updated every year. Finally, the most recent immunization practices recommended by the CDC are also included. This document is only revised when significant changes are made in this policy. There is one addendum regarding bat rabies that is included at the end.

It is hoped that this book will serve as an excellent reference for all recipients and that local ordinances can be included as well as other forms in the side pockets and back of the book. Please feel free to direct any suggestions to any member of the committee and *make sure you return the*

receipt form so that future updates are directed to the appropriate person. Thank you for your time and attention.

Sincerely,
The Companion Animal Committee of the Board of Animal Health (317/544-2387)

Dr. Maxine Ray, Chairperson
Lt. Spencer Moore, IAACP
Dr. Alan Beck, Purdue SVM
Dr. Sandra K.L. Norman, BOAH
Ms. Belinda Lewis, IAACP
Dr. Gary Patronek, Tufts University
Dr. Carol Ecker, IVMA
Dr. John Scamahorn, IVMA
Dr. Larry Glickman, Purdue SVM
Mr. Tom Prendergast, Marion Cty DOH
Dr. Sebastian Heath, Purdue SVM
Dr. Leonardo Siger, Purdue SVM
Dr. Norman Long, State Youth 4-H
Dr. Robert Teclaw, ISDH
Dr. Lawrence McAfee, BOAH
Dr. Leon Thacker, Purdue SVM/ADDL
Dr. Bret Marsh, State Veterinarian
Dr. Randy White, Purdue SVM/ADDL

INTRODUCTION

This manual is prompted by the spread of terrestrial rabies up the Eastern Seaboard and through the Mid-Atlantic region. In Indiana, we have not seen the influx of positive rabies cases that these eastern states have, but we know that the primary vector has been raccoons. It is anticipated as the virus moves its way west, our own population of both wild and domestic animals will be affected. In addition to this concern, we presently find several bats to be rabies positive and bats serve as the number one source of rabies infection for humans.

In the absence of terrestrial rabies, but with it as close as the Ohio-Pennsylvania border, we publish these guidelines to help veterinarians, animal control personnel, physicians and animal handlers to identify situations and actions necessary to be taken in order to control and contain the spread of this disease among our animal population. This in turn protects our human population from exposure and infection, minimizing the amount of treatment necessary following exposure to potentially rabid animals.

We would like to thank the states of New Jersey, New York and Connecticut for allowing us to use information from their rabies manuals which were written to deal with the epizootic in the Mid-Atlantic states. With good information and education provided to all enforcing agencies, veterinarians, and the general public, we can hopefully minimize human exposure and protect our domestic animals from this deadly disease.

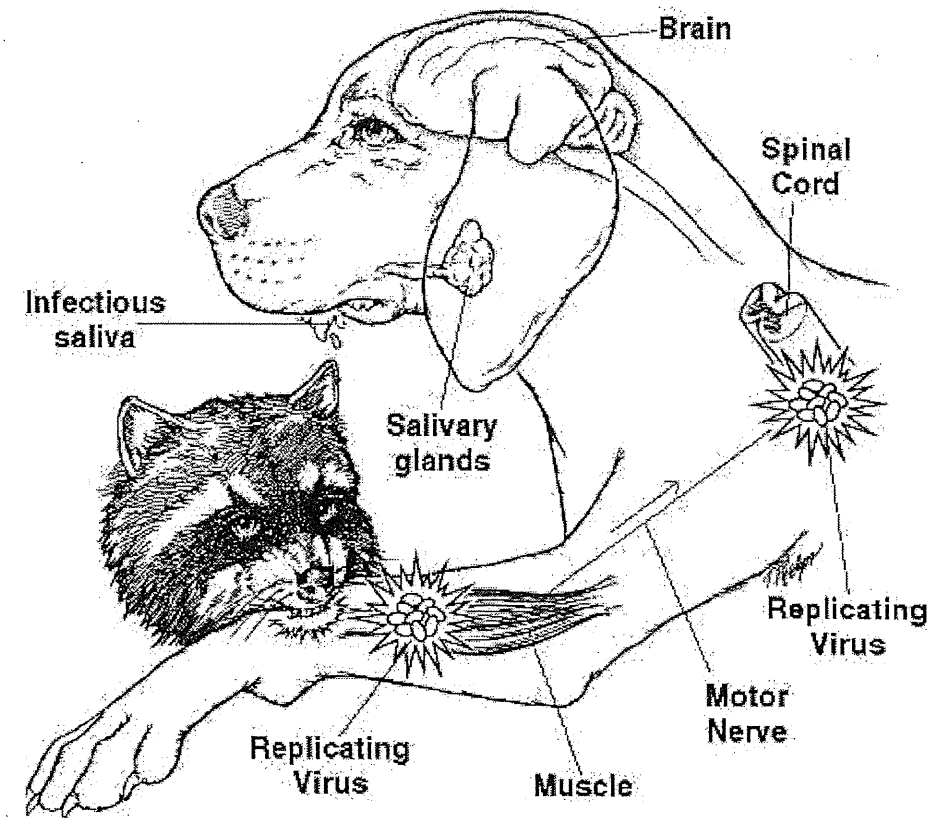
The Ins and Outs of Rabies

1. Rabies virus usually enters the dog's body through a bite wound inflicted by an infected animal and then replicates in muscle cells near the entry point.

2. Over a period of days or weeks, the virus spreads to *motor nerves* (which regulate movement of skeletal muscles) and then heads for the central nervous system. (Post exposure rabies vaccinations are effective only if administered *before* the virus reaches nerve cells.)

3. The virus replicates further in spinal cord nerve cells and then spreads throughout the nervous system causing progressive paralysis and eventually leading to coma and death. When the virus enters the brain, the notorious "mad dog" behavior begins.

4. If and when the virus reaches the *salivary glands* (often at about the time the central nervous system), it can be transmitted to other animals.



Who to Call

WHO TO CALL IF AN ANIMAL HAS BITTEN A PERSON OR ANOTHER ANIMAL

HUMAN EXPOSURE: Questions involving human exposures. Calls should first be directed to:

LOCAL DEPARTMENT OF HEALTH _____

INDIANA STATE DEPARTMENT OF HEALTH (ISDH)
2 North Meridian Stree
Indianapolis, IN 46204
Information (ISDH) 317/233-1325
Veterinary Epidemiologist 317/233-7272

DEPARTMENT OF NATURAL RESOURCES
If you have questions about wildlife or nuisance animals
Fish and Wildlife Division 317/232-4010

ANIMAL EXPOSURE: Questions concerning livestock and domestic animal exposures as well as handling animals and samples.

INDIANA STATE BOARD OF ANIMAL HEALTH (BOAH)
1202 E. 38th Street, Discovery Hall, Suite 100
Indianapolis, IN 46205-2898
State Veterinarian 317/544-2400
Companion Animal/Equine Division 317/544-2387

INDIANA VETERINARY MEDICAL ASSOCIATION (IVMA)
General Information on Rabies 317/974-0888

SUBMISSION OF SAMPLES:

STATE RABIES LABORATORY
Indianapolis - ISDH 317-921-5500
This is the only laboratory approved for rabies testing. See submission section for sample guidelines.
After hours emergency duty officer 317-233-1325

ANIMAL DISEASE DIAGNOSTIC LABORATORY (ADDL)
Purdue University 765/494-7440

ADDL - SOUTHERN INDIANA (SIPAC)
Dubois 812/678-3401
If the animal is being examined for other diseases, ADDL can forward the appropriate sample to the State Rabies Lab.

LOCAL ANIMAL CONTROL OFFICER _____

LOCAL POLICE or SHERIFF DEPARTMENT _____

STATE POLICE POST _____

ANIMAL BITES OF HUMANS

INVESTIGATION

All human animal bite wounds must be investigated in Indiana. The investigation should include, at a minimum, sufficient information to complete the **Official Indiana Animal Bite Report** form. In general, data on the biting animal, the victim, the circumstances of the bite, the name of the animal's owner (if any), and the rabies vaccination status of the biting animal should be collected. The circumstances of the bite are especially important for determining if the bite was provoked. Provoked bites are considered to be of lower rabies risk, all things being equal, than an unprovoked bite.

CONTROL MEASURES AND PREVENTION:

The most effective way to reduce the number of animal bites is to pass and enforce animal control laws and to educate the public and especially children, about potentially high risk situations. Interactions with unfamiliar pets, rough treatment of or threatening behavior toward any animal and contact with wild animals should be avoided in order to reduce bite incidents.

SIGNS AND SYMPTOMS

Most animal bite wounds that come to the attention of medical and/or public health practitioner's will consist of puncture wounds, scratches and abrasions. Severe attacks may produce crushing injuries to bones, especially in children.

TREATMENT:

More than 30 species of bacteria and at least 1 virus have been isolated from dog or cat wounds. Most of these organisms are part of the normal flora of animal mouths. Monkey bites may be especially dangerous and should be attended to quickly.

Vigorously wash bite wounds with soap and water. This is probably the most important step in preventing rabies and other infections.

Give tetanus booster to previously immunized victims if more than 5 years have elapsed since the last administration. Begin primary tetanus series in the unvaccinated.

See **Rabies Section** of this series for information on post exposure prophylaxis for that disease.

Because up to 85% of bite wounds harbor pathogens, prophylactic antibiotic treatment may be helpful.

Except for facial and very severe wounds, suturing of most bite wounds is not indicated.

PITFALLS:

An animal bite is a reportable health event. The animal bite report should be filled out completely.

A rapid investigation of the bite should be completed in order to determine whether rabies post-exposure prophylaxis is needed.

Immediate cleansing of the wound is the most important means of avoiding post bite infections, including rabies.

Although the bites of rodents, rabbits, etc. are at extremely low risk for transmitting rabies, such bites still need to be attended to in order to prevent infections with other diseases.

Bat "bites" or exposures may not always be apparent. See **Rabies Section** for more information.

RABIES

INFECTIOUS AGENT:

Rabies is caused by a rhabdovirus of the genus *Lyssavirus*. Serologic and molecular biologic techniques can distinguish among strains which are geographically distinct and/or are maintained in various animal populations, e.g. bat, raccoon and skunk.

SIGNS AND SYMPTOMS:

Rabies in animals can take a variety of forms, but a common prodromal feature is a change in behavior. Normally docile animals may become aggressive and vice versa. Animals may next progress through a "furious" phase and then a paralytic phase, though not all rabid animals exhibit all of the stages. The appearance of nocturnal animals such as raccoons and skunks during daylight hours and without fear of humans may indicate rabies infection. It is possible for an animal, especially a wild animal, to be rabid and not show any obvious clinical signs.

Rabies in humans usually begins with generalized anxiety with tingling, pain and/ or itching at the site of inoculation. This stage is followed by a nondescript flu-like illness. Next, an excitative stage, characterized by hypersensitivity to external stimuli and by hydrophobia, appears in most patients. Finally, a paralytic phase ends with death, usually due to respiratory paralysis.

TRANSMISSION:

Rabies virus is transmitted in nature through the introduction of virus-containing saliva from an infected animal into a susceptible animal or human by way of a bite or scratch, a break in the skin, or a mucous membrane . Rabies virus may be present in the saliva of animals even during the prodromal period. Human to human transmission has been reported as a result of corneal transplantation. Aerosol transmission to humans in bat caves has also been suggested.

INCUBATION PERIOD

The incubation period in humans is usually 3 to 8 weeks. Incubation periods of months to over a year are not uncommon, however.

The incubation period in animals varies. In dogs, it is usually 3 to 8 weeks, although incubation periods longer than 6 months have been reported.

PERIOD OF COMMUNICABILITY:

The period of communicability is variable and depends on the species of animal infected, among other things. In dogs, virus shedding in the saliva occurs at or a few days before the development of prodromal signs and continues until death. About 50%of field-infected dogs had rabies virus in their saliva at death. In other species of domestic and wild animals, the period of communicability is not well known. Some animals may

shed virus without exhibiting any obvious clinical signs of disease.

DIAGNOSIS:

Rabies in animals and humans is normally diagnosed by direct fluorescent antibody (FA) testing of the brain. Other tests include mouse inoculation, FA test of frozen skin sections, and serology.

INVESTIGATION:

All animal bites and other potential exposures to rabies virus should be investigated thoroughly and without delay. Every effort should be made to determine the circumstances and degree of exposure and to locate and capture the biting animal. The vaccination history of biting dogs, cats, and ferrets should be noted, as well as whether the bite was provoked or not. (See **Animal Bites** section)

CONTROL MEASURES:

Most human rabies cases in the United States are the result of direct contact with infected wildlife or indirect contact with wildlife through cats or dogs and other domestic animals. Thus, avoiding contact with wildlife, control of stray dog and cat populations, and vaccination of all dog, cats **and** ferrets (per Indiana law) would greatly reduce the risk of rabies infection for humans. In areas with epidemic wildlife rabies such as the eastern seaboard states and Texas, wildlife vaccination projects have been initiated. For the present and near future, Indiana has been spared the need for such programs.

PREVENTION:

Pre-exposure immunization is appropriate for persons, such as conservation officers, animal control workers and veterinarians, at high risk of exposure to rabies-infected animals. The primary series consists of 3 injections on days 0, 7 and 14 or 21. Post-immunization serologic testing and/or booster doses are used depending on the level of continuing risk of exposure.

Post-exposure immunization (injections on days 0, 3, 7, 14, and 28 or 35, plus rabies immune globulin) should be given under the following circumstances: 1) bites, scratches or contamination of broken skin or mucous membranes with the saliva of a known rabid animal or with any wild animal unavailable for testing, 2) encounter with a bat in which the possibility of a bite, scratch or contact with saliva can not be ruled out and 3) bites or scratches from a domestic animal, usually a cat or dog that is unavailable for testing. In 3), the circumstances of the exposure and the incidence of rabies in the geographic area should be taken into consideration when deciding whether to proceed with post-exposure immunization. For rabid **dogs, cats and ferrets only,** virus in the saliva will precede death by no more than 10 days. Thus if a dog, cat or ferret bites a human, the animal may be observed for 10 days. If it does not become ill or die within that time, it can be presumed to have not been infectious at the time of the bite, and post-exposure immunization will not be necessary. There is no known risk associated with delaying

the start of post-exposure immunization until after the 10 day observation period. **The 10 day observation period is not applicable to any other species.** An unwanted dog, cat or ferret that exposes a human should be humanely killed and the head sent for testing. (See the flow chart at the end of this section for more information on post-exposure immunization decision-making.)

Dogs, cats and ferrets with a current vaccination status and which have been bitten or otherwise exposed to a known rabid animal, carnivorous wildlife species or bat should be revaccinated and observed for 45 days. An unvaccinated dog, cat, or ferret that is exposed to a known rabid animal, carnivorous wildlife species or bat should be euthanized immediately. If the owner is unwilling to have this done, the animal should be placed in quarantine for 6 months and vaccinated 1 month prior to release.

PITFALLS:

The 10 day observation period applies only to dogs, cats and ferrets.

Most of the human rabies cases in the U.S. in recent years have been due to the bat strain of the virus. In many of these cases, there was no known bat bite, and in a few cases, no known bat exposure at all. Thus the current recommendation is that if bat exposure has occurred and a bite or other contact cannot be ruled out then post-exposure immunization is warranted.

Bites by rodents and rabbits almost never require testing or treatment. Ground hogs, opossums and livestock are rarely infected with rabies in Indiana and decisions on whether to initiate post-exposure immunization for humans exposed to these species should be based on the individual circumstances.

There has not been a rabid dog or cat diagnosed in Indiana in since 1989 and 1984, respectively. Thus, the risk of rabies transmission from these species is low, **but not** zero.

Information on vaccine can be obtained from Merieux Institute, at 1-800-VACCINE or the Chiron Corporation at 1-800-CHIRON8.

It is very important to ensure that dogs, cats and ferrets being held under observation for 10 days are kept in secure facilities (kennel, clinic, pound, home, etc.), that the persons responsible for keeping the animal under observation understand their responsibilities and that someone from the local health department determines the status of the dog, cat, or ferret after the 10 days are up. The fact that the animal did not become ill and thus was not shedding virus at the time of the bite should be communicated to the bite victim.

Rabies

RABIES INFECTIOUS AGENT:

Rabies is caused by a rhabdovirus of the genus Lyssavirus. Serologic and molecular biologic techniques can distinguish among strains which are geographically distinct and/or are maintained in various animal populations, e.g. bat, raccoon, and skunk.

SIGNS AND SYMPTOMS:

Rabies in animals can take a variety of forms, but a common prodromal feature is a change in behavior. Normally docile animals may become aggressive, and vice versa. Animals may next progress through a "furious" phase and then a "paralytic" phase, although not all rabid animals exhibit all of the stages. The appearance of nocturnal animals such as raccoons and skunks during daylight hours and without fear of humans may indicate rabies infection. It is possible for an animal, especially a wild animal, to be infected and not show any obvious clinical signs.

Rabies in humans usually begins with generalized anxiety with tingling, pain and or itching at the site of inoculation. This stage is followed by a nondescript flu-like illness. Next, an excitative stage, characterized by hypersensitivity to external stimuli and by hydrophobia , appears in most patients. Finally, a paralytic phase ends with death, usually due to respiratory paralysis.

TRANSMISSION:

Rabies virus is transmitted in nature through the introduction of virus-containing saliva from an infected animal into a susceptible animal or human by way of a bite or scratch, a break in the skin, or a mucous membrane. Rabies virus may be present in the saliva of animals even during the prodromal period. Human-to-human transmission has been reported as a result of corneal transplantation. Aerosol transmission to humans in bat caves has also been suggested.

INCUBATION PERIOD:

The incubation period in humans is usually 3 to 8 weeks. Incubation periods of months to over a year are not uncommon, however.

The incubation period in animals varies. In dogs, it is usually 3 to 8 weeks, although incubation periods longer than 6 months have been reported.

PERIOD OF COMMUNICABILITY:

The period of communicability is variable and depends on the species of animal infected, among other things. In dogs, virus shedding in the saliva occurs at or a few days before the development of prodromal signs and continues until death. About 50% of field-infected dogs had rabies virus in their saliva at death. In other species of domestic and wild animals, the period of communicability is not well known. Some animals may shed virus without exhibiting any obvious clinical signs of disease.

DIAGNOSIS:

Rabies in animals and humans is normally diagnosed by direct fluorescent antibody (FA) testing of the brain. Other tests include mouse inoculation, FA test of frozen skin sections, and serology.

INVESTIGATION:

All animal bites and other potential exposures to rabies virus should be investigated

thoroughly and without delay. Every effort should be made to determine the circumstances and degree of exposure and to locate and capture the biting animal. The vaccination history of biting dogs, cats and ferrets should be noted, as well as whether the bite was provoked or not. (See Animal Bites section.)

CONTROL MEASURES:

Most human rabies cases in the United States are the result of direct contact with infected wildlife or indirect contact with wildlife through cats, dogs and other domestic animals. Thus, avoiding contact with wildlife, control of stray dog and cat populations, and vaccination of all dogs and cats (per Indiana law) would greatly reduce the risk of rabies infection for humans. In areas with epidemic wildlife rabies such as the eastern seaboard states and Texas, wildlife vaccination projects have been initiated. For the present and near future, Indiana has been spared the need for such programs.

PREVENTION:

Pre-exposure immunization is appropriate for persons, such as conservation officers, animal control workers and veterinarians, at high risk of exposure to rabies-infected animals. The primary series consists of 3 injections on days 0, 7 and 21 or 28. Post-immunization serologic testing and/or booster doses are used depending on the level of continuing risk of exposure.

Post-exposure immunization (injections on days 0, 3, 7, 14, and 28, plus rabies immune globulin on day 0) should be given under the following circumstances: 1) bites, scratches or contamination of broken skin or mucous membranes with the saliva of a known rabid animal or with any wild carnivore unavailable for testing, 2) encounter with a bat in which the possibility of a bite, scratch or contact with saliva can not be ruled out, and 3) bites or scratches from a domestic animal, usually a cat or dog, that is unavailable for testing. In 3), the circumstances of the exposure and the incidence of rabies in the geographic area should be taken into consideration when deciding whether to proceed with post-exposure immunization. For rabid dogs, cats and ferrets only, virus in the saliva will precede death by no more than 10 days. Thus, if a dog, cat or ferret bites a human, the animal may be observed for 10 days. If it does not become ill or die within that time, it can be presumed to have not been infectious at the time of the bite, and post-exposure immunization will not be necessary. There is no known risk associated with delaying the start of post-exposure immunization until after the 10 observation period. The 10 day observation period is not applicable to any other species. An unwanted dog, cat or ferret that exposes a human should be humanely killed and the head sent for testing. (See the flow chart at the end of this section for more information on post-exposure immunization decision-making.)

Dogs, cats and ferrets with a current vaccination status and which have been bitten or otherwise exposed to a known rabid animal, carnivorous wildlife species or bats should be revaccinated and observed for 45 days. An unvaccinated dog, cat or ferret that is exposed to a known rabid animal, carnivorous wildlife species or bat should be euthanized immediately. If the owner is unwilling to have this done, the animal should be placed in strict isolation for 6 months and vaccinated 1 month prior to release.

PITFALLS:

The 10 day observation period applies only to dogs, cats and ferrets.

Most of the human rabies cases in the U.S. in recent years have been due to the bat strain of the virus. In many of these cases, there was no known bat bite, and in a few cases, no known bat exposure at all. Thus the current recommendation is that if bat exposure has occurred and a bite or other contact can not be ruled out, then post-exposure immunization is warranted.

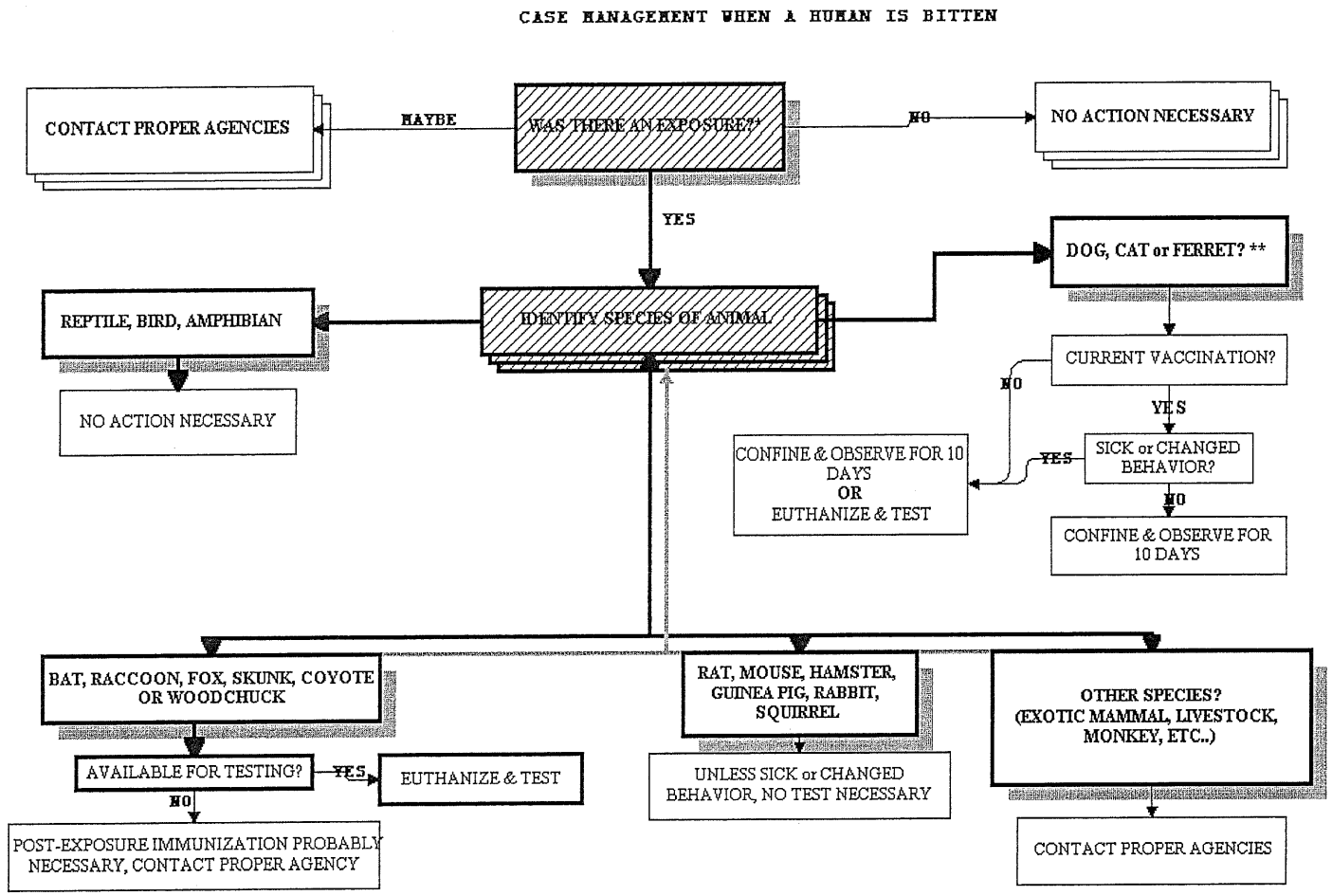
Bites by rodents and rabbits almost never require testing or treatment. Ground hogs, opossums and livestock are rarely infected with rabies in Indiana and decisions on whether to initiate post-exposure immunization for humans exposed to these species should be based on the individual circumstances.

There has not been a rabid dog or cat diagnosed in Indiana in over since 1989 and 1984, respectively. Thus, the risk of rabies transmission from these species is low but not zero.

Information on vaccine can be obtained from Merieux Institute at 1-800 VACCINE or the Chiron Corporation at 1-800-CHIRON8.

It is very important to ensure that dogs, cats and ferrets being held under observation for 10 days are kept in secure facilities (kennel, clinic, pound, home etc.), that the persons responsible for keeping the animal under observation understand their responsibilities, and that someone from the local health department or other agency determines the status of the dog or cat after the 10 days are up. The fact that the animal did not become ill and thus is not rabid should be communicated to the bite victim as soon as possible.

Case Management



* See "Rabies Prevention - United States 1991" in the Appendix

** For dogs, cats and ferrets only, a 10 day confinement and observation period may be ordered in place of euthanisia and testing of the brain. Bites to the head by unvaccinated dogs, cats or ferrets showing signs of illness or changed behavior are considered to be of the highest risk and may war rent immediate testing. Local laws should be consulted when considering euthanasia of strays.

Animal Management Plan

ANIMALS BITING ANIMALS

Bites to animals are not reportable events in most counties, but create much concern among animal owners when their pets may have been exposed to a rabies suspect, especially non-domestic animals. Because our pets have the closest contact with the human population, they serve as the potential reservoir of rabies infection for people. Only through vaccination of *all* dogs and cats do we minimize this risk. There are populations of unvaccinated dogs and cats that need to be dealt with in both human and animal bites. This section deals with animal-to-animal contact and the proper handling of these cases.

Included in the appendix and referred to in this section is the *Compendium on Animal Rabies Control* which is updated each year by the National Association of State Public Health Veterinarians. It has been incorporated into Indiana law (345 IAC 1-5 sec 3) as the reference for vaccination and handling of animals in bite situations. This is to be updated each year with the most recent information regarding vaccination and animal disposition in various situations. Some events have to be handled on a case-by-case basis and consulting with the Board of Animal Health for a decision in these matters will be necessary.

Also included in this section are general guidelines for confinement in different situations. Each county or municipality may have its own guidelines and requirements which are incorporated into its animal control statute. These are provided for those local agencies who need some guidance as to what to do with an animal in one of those situations where it may have had contact with a positive animal or rabies suspect.

With good management of difficult situations and continuous emphasis on vaccination of all dogs and cats in Indiana, it is hoped that most of the animal to animal bites can have a satisfactory outcome for both owners and animals.

Guideline for Confinement

GUIDELINES FOR QUARANTINE

One essential component of effective rabies control is the management of dogs and cats known to or suspected to have been exposed to rabid (or suspect rabid) animal, or to have bitten or exposed a person. Based upon the circumstances involved in the bite and the vaccination status of the animal involved, one of the following quarantine plans will be required at the discretion of the animal control officer involved.

QUARANTINE PLANS:

A. CLOSE OBSERVATION

a. Animal shall be kept on owner's premises.
b. Owner shall be informed of potential rabies.
c. Owner shall be required to notify enforcing agency of unusual behavior or change in health status of pet.

B. STRICT CONFINEMENT

a. Animal shall be kept on designated property - in the house, garage, or other escape-proof building or enclosure approved by the local director of health.
b. Animal shall be leash-walked under immediate control of an adult on property designated for confinement.
c. Owner shall be informed of potential rabies and given instructions in writing.
d. Owner is required to notify immediately enforcing agency of unusual behavior or change in health status of pet.

C. QUARANTINE

a. Animal shall be confined off owner's property in a designated facility, i.e., animal shelter, veterinary hospital or qualified commercial kennel.
b. Strict quarantine on owner premises shall be possible at discretion of animal control. (See back of page for additional details.)
c. In case of death of quarantined animal, contact local animal control or health official. **DO NOT DISPOSE OF ANIMAL!**

Facility used for quarantine shall:

1. Ensure an escape-proof environment which prevents human and other animal contact.

2. Be verifiable (i.e., subject to unannounced periodic spot checks by the animal control or local health department).
   a. outside cage with double walls (must be sufficient housing to shelter animal from the weather).
   b. indoor cage
      1. since the walls of the main building serve as a second barrier, indoor may be single-walled.
      2. an example of a cat confinement pen is shown in Figure 1 although it is recommended that these dimensions be significantly enlarged to provide more comfort for the animal.
      3. some sort of divider system as illustrated in Figure 2 (to exclude positively any human contact) is recommended in very high-risk cases (i.e., unvaccinated animal bitten by known or highly suspected rabies vector).
      4. enclosing part of a basement, indoor porch, or recreation room which has windows available for health department officials to monitor confinement compliance is acceptable.

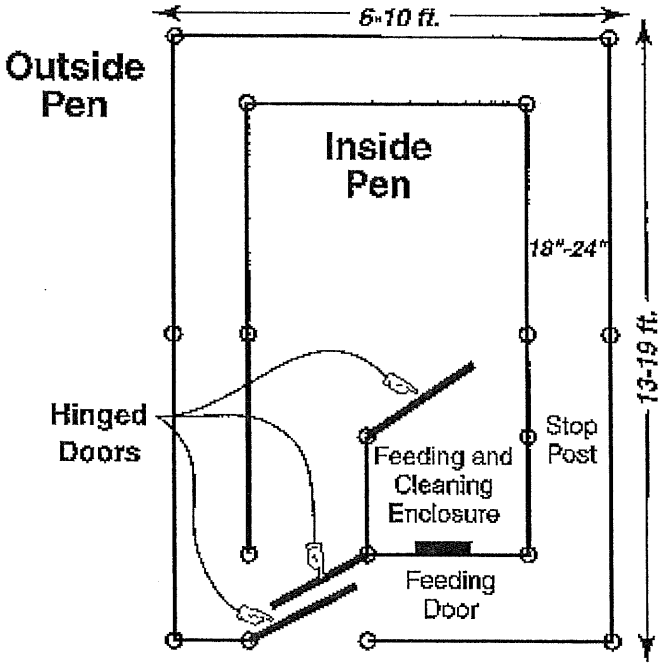
When the exposed animal is unvaccinated, euthanasia is recommended. Alternatively, the owner has the option of arranging for a 6-month strict confinement. Confinement must be strict because of the special public health risks associated with these animals (i.e., those potentially incubating rabies), and the need to prevent human and other animal exposures form occurring should rabies symptoms develop.

Recommended Construction for 6 Months

Recommended specifications: Note: Overall length and width may vary

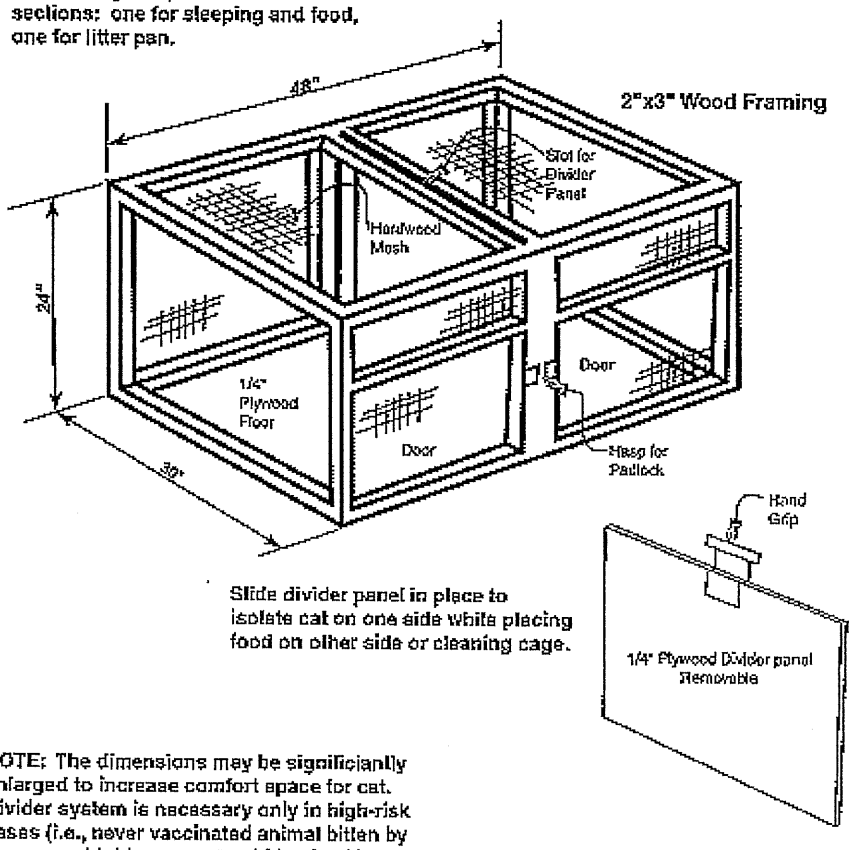
1. Height of inside pen at least 6 feet or 3 times the height of the dog at the shoulder.
2. Height of outside pen at least 4 feet.
3. Floor of inner pen should be covered with chainlink extending at least 1 1/2 feet from inner pen wall toward center of pen or down in the ground to prevent digging out.
4. Feeding and cleaning enclosure and door recommended to prevent human contact with animal during feeding cage cleaning.
5. Posts: 4 x 4 pressure-treated wood or equivalent; driven or set in concrete, 1 1/2 feet down.
6. Inside pen: Wire chainlink 12 1/2 gauge or lower, or equivalent. Welded mesh or diamond link.
7. Outside pen: 1 foot x 1 foot hardware or poultry mesh or stronger.

Prepared by Veterinary Public Health, Biological Services Program, Consumer Health Services, New Jersey State Department of Health.



Isolation Cage for One Cat

NOTE: Cage may be divided into two sections: one for sleeping and food, one for litter pan.



Slide divider panel in place to isolate cat on one side while placing food on other side or cleaning cage.

NOTE: The dimensions may be significiantly enlarged to increase comfort space for cat. Divider system is necessary only in high-risk cases (i.e., never vaccinated animal bitten by known, or highly suspect, rabid animal.)

SUBMISSION OF SAMPLES

When the decision is made to either euthanize an animal or submit a dead animal for rabies examination, several procedures must be followed to obtain quick and accurate result. Many times rabies prophylaxis in a human or vaccination of an animal is dependent on these results. The U.S. mail is not accepting samples for delivery and United Parcel Service will only deliver properly packaged specimens. It is important that shipping guidelines be followed or the test results will be delayed.

Included in this section also is the Rabies Examination Form. It needs to be filled out entirely in order for the accurate interpretation of results. The veterinarian who submits the sample can provide some of the information as well as the animal control official, health official, animal owner and bite victim. Cooperation in this process and sharing of information will give everyone involved a better outcome in any situation.

Maps and phone numbers of Laboratories that can be used for samples are also included. **REMEMBER -** only the Rabies laboratory at ISDH can run the test for rabies in an animal. The diagnostic laboratory at Purdue and in Southern Indiana can submit the proper specimen if the animal is being examined for other reasons.

Following suggested guidelines will allow for quick, accurate results and resolution of potentially hazardous situations.

RABIES SPECIMEN REQUEST

State Form 37763 (R11/10-09)

Reset Form

Indiana State Department of Health Laboratory
550 W. 16th Street, Suite B
Indianapolis, IN 46202
(317) 921-5500

Use a separate form for each specimen. Instructions on reverse side of this page

Section 1. Submitter

Submitter

Last Name | First Name | MI

Number & Street Address | City | State | ZIP Code

Telephone Number | FAX Number

Type of Submitter ☐ Animal Control ☐ Veterinarian ☐ Local Health Dept. ☐ Humane Society ☐ Private Citizen ☐ Shelter ☐ Other _____

Section 2. Exposure

Human Exposure? ☐ Yes ☐ No ☐ If Unknown Why Submitted: _____

Last Name | First Name | MI | Telephone Number

Number & Street Address | City | State | ZIP Code

Date of Exposure / / Type of Exposure ☐ Scratch ☐ Bite ☐ Handling ☐ Other _____

Last Name | First Name | MI | Telephone Number

Number & Street Address | City | State | ZIP Code

Date of Exposure / / Type of Exposure ☐ Scratch ☐ Bite ☐ Handling ☐ Other _____

Section 3. Animal Submitted Information

Type of Animal? ☐ Dog ☐ Cat ☐ Bat ☐ Raccoon ☐ Skunk ☐ Squirrel ☐ Opossum ☐ Equine ☐ Bovine ☐ Other _____

Identify breed, color marking _____

Number & Street Address Where Animal was Found | City Where Animal was Found | State | ZIP Code

County _____ GPS Coordinates Latitude | Longitude

Date of Death of Animal / / | Date Specimen Collected / / | Date Specimen Shipped / /

Did the animal exhibit any of the following rabies symptoms? *(Check all that apply)*

☐ Convulsions ☐ Aggression ☐ Excessive salvation ☐ Paralysis ☐ Unable to eat or drink

☐ Noticable change in behavior ☐ Unknown ☐ None

Other Signs/Symptoms *(specify)*: _____

Was animal immunized? ☐ Yes ☐ No ☐ Unknown

If treated by a veterinarian, complete the following

Veterinarian Last Name | Veterinarian First Name | MI

Veterinarian Office Address | City | State | ZIP Code

Telephone Number

INSTRUCTIONS FOR THE SUBMISSION OF ANIMAL HEADS AND BATS FOR RABIES TESTING

SPECIMEN

Since brain tissue is examined for the diagnosis of rabies, only the animal head will be accepted for diagnostic purposes. Animals should be euthanized in a manner that will not destroy the brain. The neck should be severed at the midpoint between the base of the skull and shoulders. For bats only, the whole dead animal should be submitted. Brain material from animals with central nervous disease symptoms may be submitted by veterinarians or veterinary diagnostic laboratories as part of their diagnostic process without regard to bite or other exposure status. Only fresh, non-fixed tissue is acceptable. A negative finding for rabies can be made only if a complete cross section of the brain stem and cerebellum is examined. Examination of the brain stem may be made at the level of the pons, medulla, or midbrain. All rabies specimens must be properly packaged before delivery to the Indiana State Department of Health (ISDH) Laboratories. **For high priority specimens, please alert the lab (317.921.5834) and send a fax copy of the rabies submission form (317.927.7804). Provide tracking numbers when available.**

SPECIMEN SUBMISSION

Specimens can be submitted by LimsNet, an online system that will make results available as PDF files the minute they are released from the lab. To get a free LimsNet account established at your facility for electronic submission and results reporting, call the help desk at (888) 535 0011 or email to LimsAppSupport@isdh.in.gov. Alternatively, a completed Rabies Specimen Request Form must accompany each specimen. The submission form can be found online at http://www.in.gov/icpr/webfile/formsdiv/37763.pdf. An incomplete form may delay testing and make it more difficult to convey vital information to the person(s) exposed**.**

PACKAGING OF SPECIMENS

Place animal head specimens or whole bat specimens in a leak proof container (e.g., double bag using heavy-duty plastic bags or a metal can with lid) and seal tightly. Place the leak proof container in an insulated shipping carton (e.g., styrofoam shipper) with sufficient cold packs to maintain refrigeration temperature during shipment. **Do not use wet ice.** Avoid the use of "packing peanuts" inside the insulated shipper. Place the insulated shipping carton into a cardboard shipping box, close lid, and seal. Specimens should be kept cold, but preferably not frozen. Freezing the head will delay testing, since it may take up to 24 hours to thaw; it also damages the brain tissue.

SHIPMENT OF SPECIMENS

Shipment via courier service is usually the most rapid method of delivery. The US Postal Service will not accept this type of specimen for mailing. At the time of this printing, United Parcel Service (UPS) will accept specimens for delivery to the ISDH Laboratories if properly packaged. Consult with your local UPS representative to obtain the most current shipping/packaging requirements for UPS. Use the following address for shipping specimens

Indiana State Department of Health Laboratories
Rabies Laboratory
550 West 16th Street, Suite B
Indianapolis, IN 46202

To contact the Rabies Lab by phone or fax:
317.921.5842 (8:15 -4:45 M-F, except holidays)
317.233.1325 (after hours ISDH duty officer)
317.927.7804 FAX

REPORTING OF RESULTS

Positive rabies test results will be reported immediately by telephone to both the local health department officials and to the submitter of the specimen. Negative test results will be routinely reported by fax if a fax number is provided.

MAMMALS IN THE ORDER RODENTIA

Squirrels, mice, hamsters, gerbils, guinea pigs, rats, or other animals that have a very low or non-incidence of rabies will not be tested unless there is a human bite or other exposure involved **and with prior approval** of the ISDH Laboratory Director (317.921.5808) or Veterinary Epidemiologist (317.233.7272).

CONTACTS FOR FURTHER INFORMATION

For questions concerning suspected rabies incidents involving possible human exposure, contact the ISDH Veterinary Epidemiologist, at 317.233.7272. For questions concerning suspected rabies incidents involving possible domestic animal exposure, contact the director of Companion Animal/Equine at the Indiana State Board of Animal Health, at 317.544.2389. For general laboratory questions, contact the ISDH Laboratories at 317.921.5500.

Hand Delivery of Rabies Suspect to ISDH Rabies Laboratories

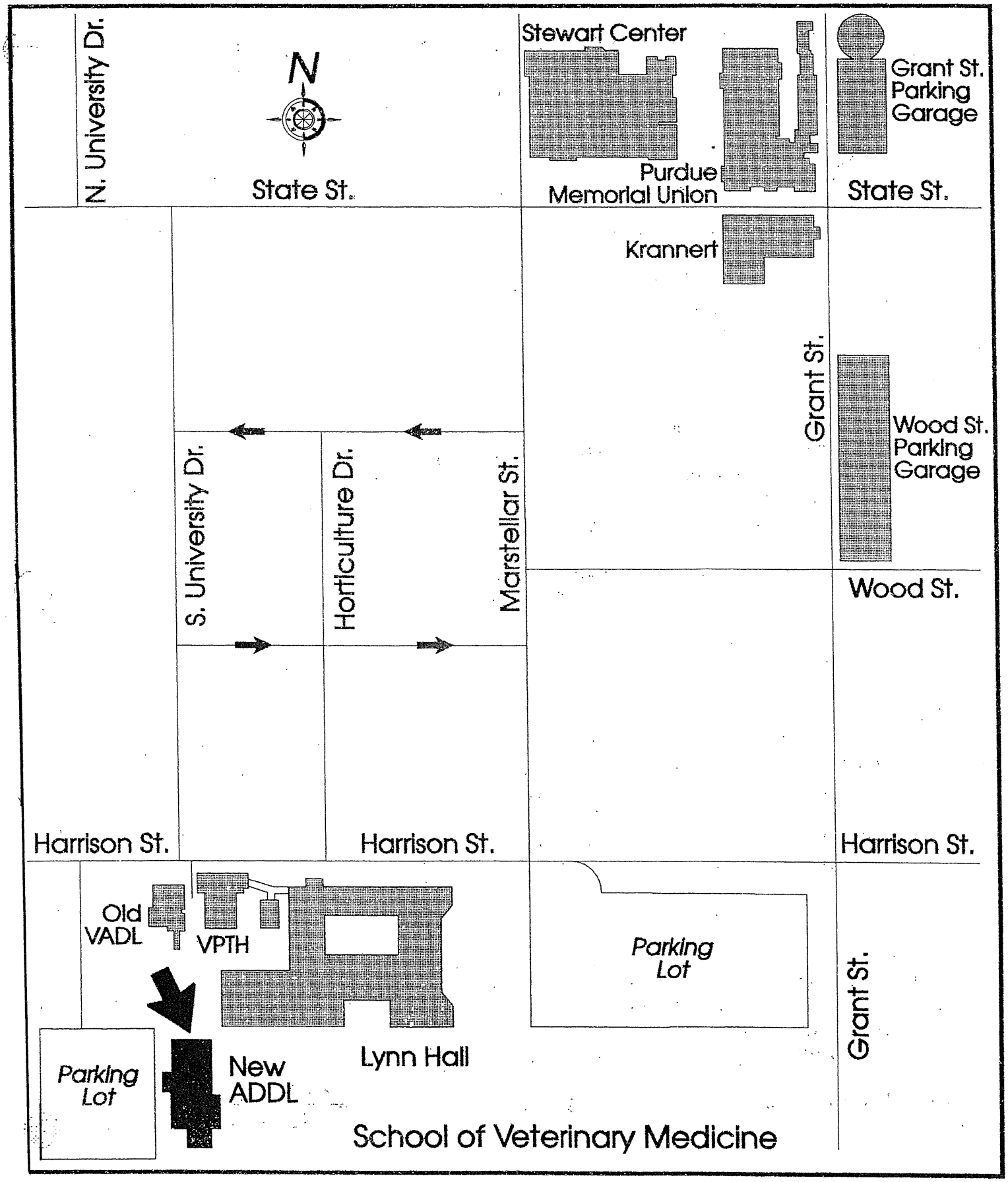
The Indiana State Health Department (ISDH) Rabies Laboratory is located at 550 West 16th Street, Suite B Indianapolis, IN 46202. This is just west of I-65 on W. 16th Street on the above map.

Rabies suspects may be hand delivered to Room N189 at the above address during normal business hours 8:30AM to 4:30 PM, Indianapolis time, Monday thru Friday. Emergency deliveries may be arranged by phoning the Laboratory at 317.921.5500 and requesting either Tom Cronau or Lixia Liu. Personal delivery after hours, weekends, or holidays if emergency call the after hours emergency duty officer at 317.233.1325. Rabies suspects must be properly packaged with the necessary laboratory request forms completed when delivered. Please consult the instructions on the back of the submission forms or contact the ISDH Laboratory for additional information.

When shipping suspects, the best method to use is UPS. Avoid sending if the suspect will arrive on a weekend or holiday. Freeze or refrigerate specimen at origin until shipping/arrival date would be Monday thru Friday. Freeze the specimens only if they must be held more than 48 hours prior to shipping.

Positive test results are reported on the day the test is completed by calling the individual designated on the submission form. Negative results are mailed to the identified submitter in 1-2 days after the test is completed. The appropriate staff at the local county health department, the ISDH, and the Indiana Board of Animal Health is promptly notified of all positive results by e-mail and/or fax.

Purdue University School of Veterinary Medicine ADDL (317) 494-7440
West Lafayette, Indiana 47907



map by Brad Bernhardt

INSTRUCTIONS ON HOW TO GET TO THE ANIMAL DISEASE DIAGNOSTIC LABORATORY (ADDL)

FROM I 65 (north or south)

I 65 to 43 South
43 south to State Road 26 West (about 5 miles-McDonald's on right)
right on 26 West to Grant Street (2nd light) (University bookstore and Krannert building on opposite corners)
left (south) on Grant to Harrison (4-way stop)
right (west) on Harrison to ADDL sign (on left)
left (south) into parking lot-stay to right-down hill

FROM 52 BYPASS

To Salisbury (Sorrento's - MCL Cafeteria)
south on Salisbury to T (26 west) (Triple XXX on left side)
right (west) on State Street to Grant (2nd light) (University Bookstore and Krannert Building on opposite corners)
left (south) on Grant Street to Harrison (4-way stop)
right (west) on Harrison to old ADDL
left (south) into parking lot directly west of old ADDL
Drive through parking lot-stay to right-down hill on left.

FROM 231 SOUTH

231 NORTH to 26 West
26 West through town to Grant Street (2nd Light past 43) (University Bookstore and Krannert Building on opposite corners)
left (south) on Grant to Harrison (4-way stop)
west (right) on Harrison to old ADDL
left (south) into parking lot directly west of old ADDL
Drive through parking lot-stay to right-down hill on left.

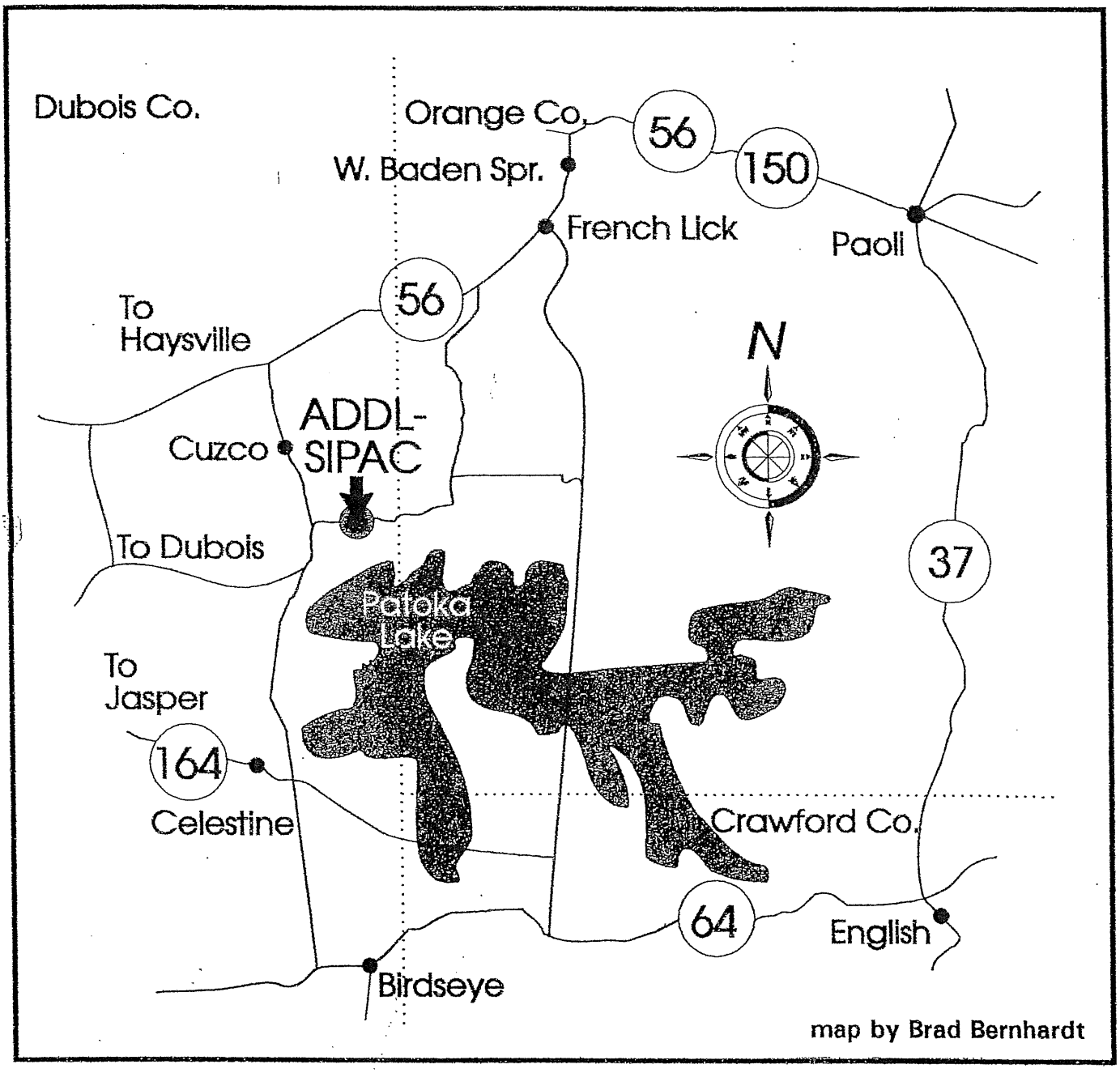
FROM 26 West (Otterbein, Pine Village, etc)

26 East to Russell Street (stop light-Lily Hall on right)
right (south) on Russell to Harrison (3-way Stop)
left (east) on Harrison to 1st right (parking lot)
right (south) into parking lot
Drive through parking lot-stay to right - down hill on left

State Road 26 is also known as State Street

ADDL-SIPAC

11367 E. Purdue Farm Road
Dubois, IN 47527-9666
(812) 678-3401



ADDL-SIPAC between Ind 56 and Ind 164 in eastern Dubois County

Indiana Rabies Laws and Regulations

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

Section 1

a. For the purpose of administering IC 15-17-6 and this rule, an animal is deemed to be vaccinated for rabies only when the following provisions are met:
    1. The animal is vaccinated by a veterinarian that is:
        A. licensed to practice veterinary medicine; and
        B. accredited by the United States Department of Agriculture under 9 CFR, Subchapter J.
    2. The vaccine used must be licensed and approved by the United States Department of Agriculture. The dosage and administration of the vaccine used must be in accordance with this rule and the manufacturers' specifications described on the vaccine's label and package insert.
b. The veterinarian performing a rabies vaccination of an animal shall do the following:
    1. Complete a vaccination certificate or computerized record, in triplicate, on each animal being vaccinated for rabies that shall include the following information:
        A. The name and address of the animal's owner.
        B. The species, sex, and age of the animal vaccinated.
        C. The date the animal was vaccinated.
        D. The product name and lot or serial number of the vaccine used.
        E. The date the animal must be revaccinated under section 2 of this rule.
        F. The number of the tag issued if a tag is issued under subdivision (3).
        G. The name of the veterinarian completing the vaccination and his or her Indiana veterinary license number.
    2. The rabies vaccination certificate completed under subdivision (1) shall be distributed as follows:
        A. One (1) copy of the certificate or computerized record shall be given to the owner or custodian of the animal being vaccinated for rabies.
        B. One (1) copy of the certificate or computerized record shall be forwarded to the county health officer or the officer's designated agent upon the county health officer's request, or as the state veterinarian otherwise directs, within thirty (30) days of the vaccination.
        C. One (1) copy of the certificate or computerized record shall be retained by the veterinarian vaccinating such animal covering the period of immunization
    3. A veterinarian that vaccinates a dog, cat, or ferret shall furnish to the owner or custodian of the animal a rabies vaccination identification tag that contains the following:
        A. The veterinarian's or clinic's name and telephone number.
        B. A unique identification number.

C. The owner or custodian of an animal vaccinated for rabies shall keep a copy of the certificate and tag required to be issued under subsection (b) until such time as the animal must be revaccinated under section 2 of this rule. The board recommends that the owner or custodian of a dog affix the rabies vaccination tag to the collar or harness of the dog and that it be worn at all times. Nothing in this rule shall prevent a local unit of government from requiring that rabies vaccination tags be worn at all times. (d) Animals that have been vaccinated for rabies are subject to all quarantine provisions that may be imposed by state or local regulations. The final determination of an animal's rabies vaccination status shall be made by the state veterinarian.

345 IAC 1-5-2 Required rabies vaccination of dogs, cats, and ferrets
Section 2

All dogs, cats, and ferrets three (3) months of age and older must be vaccinated against rabies. The rabies vaccination of a dog, cat, and ferret shall be maintained by ongoing revaccination of the animal as follows:

1. Ferrets shall be revaccinated within twelve (12) months of the prior vaccination.
2. Dogs and cats that are vaccinated with a rabies vaccine whose label recommends annual boosters shall be revaccinated within twelve (12) months of the prior vaccination.
3. Dogs and cats that are vaccinated with a rabies vaccine whose label recommends a booster one (1) year later and triennially thereafter shall be revaccinated within twelve (12) months of the first vaccination and shall be revaccinated within thirty-six (36) months of each vaccination thereafter. The owner of the animal is responsible for procuring the vaccinations required by this section.

345 IAC 1-5-3 Animal rabies control program
Section 3

a. The state veterinarian shall establish a statewide animal rabies control program. The rabies control program shall include the following:
    1. The rabies vaccination requirements in this rule.
    2. The rabies vaccine distribution requirements in 345 IAC 1-1.1.
    3. The rabies control requirements for the following:
        A. Moving animals into the state in 345 IAC 1-3.
        B. Exhibition of animals in 345 IAC 7-5.
    4. Other requirements in IC 15-17-6 and this rule.
    5. Other programs initiated by the state veterinarian for the purposes of:
        A. preventing;
        B. detecting;
        C. controlling; and
        D. eradicating;

    rabies.

b. The following components of the Compendium of Animal Rabies Control, 2005, National Association of State Public Health Veterinarians, Inc., are incorporated by reference as rules of the Indiana state board of animal health and shall be used in the implementation of the program established under subsection (a):
    1. Part I(B)(1) "Prevention and control methods in domestic and confined animals" and Part II "Recommendations for Parenteral Rabies Vaccination Procedures" when interpreting and implementing the animal vaccination requirements in this rule.
    2. Part I(B)(5) and Part I(B)(6) "Postexposure management" when interpreting and implementing IC 15-17-6 governing animal bites.
c. Where the matters incorporated by reference in this section conflict with the provisions of IC 15-17-6 and this rule, the express provisions of the statute and this rule shall control

NOTE: IC 35-46-3-1 - Harboring a nonimmunized dog

A person who knowingly or intentionally harbors a dog that is over the age of six (6) months and not immunized against rabies commits harboring a nonimmunized dog, a class C infraction. However, the offense is a class B misdemeanor if the dog causes bodily injury by biting a person.

Management of Animal Bites to Humans 410 IAC 1-2.3

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

Section 52

a. The specific control measures for animal bites are as follows:
    1. Every case of a human bitten by a domestic or wild mammal shall be reported promptly to the local health officer or his or her designee having jurisdiction. If a physician is in attendance, such physician shall report the bite. If no physician is in attendance and the person bitten is a child, it shall be the duty of the parent or the guardian to make such a report immediately. If the person bitten is an adult, such person shall make the report or, if incapacitated, the bite shall be reported by whoever is caring for the person bitten. It shall be the duty of the local health officer to report information concerning the bite on the prescribed form. The report shall include requested information on postexposure rabies prophylaxis if it is being administered to the bite victim. Each reported bite shall be investigated immediately by the local health officer or a designee. This investigation shall be conducted with the purpose of determining the need for postexposure rabies prophylaxis of the bite victim and either:
        A. imposing a ten (10) day observation period on the biting animal (dog, cat, or ferret only) to determine if the animal was capable of transmitting rabies at the time of the biting incident; or

B. submission of the head, if the biting animal is a potential rabies vector, to the department laboratory to determine if it was infected with rabies.

2. Isolation is not necessary.
3. Concurrent disinfection is not necessary.
4. Quarantine shall be applied as follows:
    A. Any apparently healthy dog, cat, or ferret that has bitten a person, or any dog, cat, or ferret suspected of being rabid shall be confined and held in observation for the period specified in IC 15-17-6-11 (not less than ten (10) days) or humanely killed at once for laboratory examination. Such confinement shall be under the supervision of the state veterinarian or a licensed, accredited veterinarian, or other person designated by the official quarantining the animal, and at the expense of the owner.
    B. Any illness in the confined dog, cat, or ferret shall be reported immediately to the local health department. Animals under confinement shall not be immunized against rabies during the observation period. The head of any such dog, cat, or ferret that dies during the period of observation, or is killed subsequent to having bitten a person or another animal, shall be removed, packed in an iced container, but not frozen, and forwarded immediately to the laboratory of the department for rabies testing.
    C. Any stray, unwanted, or unhealthy dog, cat, or ferret that has bitten a person shall be humanely killed immediately for laboratory examination. The animal′s owner shall be responsible for having the unwanted or unhealthy animal euthanized, head removed, and shipped to the department for rabies examination. In the case of a stray animal or an animal whose owner cannot be found, the local health department or its designee shall assume this responsibility.
    D. Any potentially rabid wild mammal that has bitten a human or a domestic animal, or is suspected of being rabid, shall not be placed under observation, but shall be humanely killed at once in a manner that does not cause trauma to the head or brain. The head shall be refrigerated, but not frozen, and submitted within forty-eight (48) hours to the laboratory of the department. Wild mammals include, but are not limited to, the following:
        i. Wild animals kept as pets.
        ii. Wild mammals crossbred to domestic dogs and cats.
    E. The bite victim shall be notified after a dog, cat, or ferret has passed the ten (10) day observation period in a healthy state or after the results of a laboratory test are available.
    F. Any person bitten or scratched by a wild carnivorous mammal or bat not available for rabies testing should be regarded as having been potentially exposed to rabies. The following chart provides information on quarantine and disposition of biting animals.

Animal Type	Evaluation and Disposition of Animal	Postexposure Prophylaxis Recommendation
Dogs, cats, and ferrets	Healthy and available for	Should not begin prophylaxis unless

	10 day observation[1]	animal develops symptoms of rabies[2]
	Rabid or suspected rabid	Immediate postexposure prophylaxis
	Unknown	Consult public health officials
Skunks, raccoons, bats[3], foxes, and most other carnivores; woodchucks and wild animals kept as pets	Regard as rabid unless geographic area is known to be free of rabies or until animal proven negative by laboratory testing[4]	Immediate postexposure prophylaxis or if animal available for testing, as soon as positive result is observed
Livestock, rodents, and lagomorphs (rabbits and hares)	Consider individually	Consult public health officials. Bites of squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, mice, other rodents, rabbits, and hares almost never require antirabies treatment.

[1]Stray dogs and cats may be euthanized immediately and their heads submitted to the rabies laboratory.

[2]Postexposure prophylaxis should be started if a veterinarian identifies an animal as being symptomatic. Symptomatic animals should be euthanized and tested immediately.

[3] What appears to be insignificant contact with bats may result in rabies transmission, even without clear evidence of a bite. Postexposure prophylaxis is recommended for all persons with bite,scratch, or mucous membrane exposure to a bat unless the bat is available for testing and is negative for rabies. Postexposure prophylaxis is appropriate even in the absence of bite, scratch, or mucous membrane exposure in situations in which there is a reasonable probability that such contact occurred (for example, a sleeping individual awakes to find a bat in the room, an adult witnesses a bat in the room with a previously unattended child, mentally challenged person, or intoxicated person) and rabies cannot be ruled out by testing the bat.

[4]The animal should be killed and tested as soon as possible. Holding for observation is not recommended as time lapse from virus secretion in saliva until clinical symptoms appear have not been determined for species other than a dog, cat, and ferret. Consult with the department veterinary epidemiologist for information on presence or absence of rabies in particular species.

b. All bite wounds should be treated immediately in the following steps:
    1. Clean and flush wound as first aid.
    2. Thorough wound cleansing under medical supervision.
    3. Evaluation of need for postexposure prophylaxis.
    4. Tetanus prophylaxis and antibacterial treatment as required.
c. If the decision is made to provide postexposure prophylaxis to the individual, the following protocols must be followed, and a decision to provide postexposure prophylaxis must be reported to the department:

Guidelines for Postexposure Prophylaxis

Vaccination Treatment Regimen*

Status		
Not previously vaccinated	Local wound cleaning	All postexposure treatment should begin with immediate thorough cleansing of all wounds with soap and water.
	Human rabies immune globulin (HRIG)	20 IU/kg body weight. If anatomically feasible, the full dose should be infiltrated around the wound or wounds. Any remaining volume should be administered intramuscularly at a site distant from vaccine inoculation.
	Vaccine	Human diploid cell vaccine (HDCV), purified chick embryo cell vaccine (PCEC), or rabies vaccine adsorbed (RVA), 1.0 ml, IM (deltoid[1]), 1 each on days 0, 3, 7, 14, and 28.
Previously vaccinated[2]	Local wound cleaning	All postexposure treatment should begin with immediate thorough cleansing of all wounds with soap and water.
	HRIG	Should not be administered.
	Vaccine	HDCV, PCEC, or RVA, 1.0 ml IM (deltoid[1]), 1 each on days 0 and 3.

*These regimens are applicable for all age groups, including children.

[1]The deltoid area is the only acceptable site of vaccination for adults and older children. For younger children, the outer aspect of the thigh may be used. The vaccine should never be administered in the gluteal area.

[2]Any person with a history of preexposure vaccination with HDCV or RVA; prior postexposure prophylaxis with HDCV or RVA; or previous vaccination with any other type of rabies vaccine and a documented history of antibody response to the prior vaccination.

NATIONAL ASSOCIATION of STATE PUBLIC HEALTH VETERINARIANS, INC.

May 31, 2011

MEMORANDUM

TO: State Public Health Veterinarians
State Epidemiologists
State Veterinarians
Other Parties Interested in Rabies Prevention and Control

FROM: Catherine M. Brown, DVM, MSc, MPH, Chair
Compendium of Animal Rabies Prevention and Control Committee

SUBJECT: *Compendium of Animal Rabies Prevention and Control, 2011*

The National Association of State Public Health Veterinarians (NASPHV) is pleased to provide the 2011 revision of the Compendium of Animal Rabies Prevention and Control for your use and for distribution to practicing veterinarians, wildlife rehabilitators, animal welfare organizations, and officials in animal control, public health, wildlife management, and agriculture in your state. This document is reviewed and revised as necessary, and the most current version replaces all previous versions. This cover memo summarizes the most notable changes that were made to the document and provides updates on other rabies issues.

COMPENDIUM CHANGES

Part I A.1. The national case definition for animal rabies was added for clarification of how rabies cases are defined for public health surveillance purposes.

Part I A.9. was expanded to: clarify that the Centers for Disease Control and Prevention's (CDC) rabies laboratory is available for confirmatory testing and on an emergency basis to expedite exposure management decisions; include information on testing methodology appropriate for field testing of surveillance specimens; and to clarify that there are no reliable ante mortem rabies tests available for use in animals.

Part I A.11. was expanded to include additional research topics that warrant further study.

Part III: The table of rabies vaccines licensed and marketed in the U.S. was updated for 2011.

Additional references have been added to provide scientific support for information provided in the document.

RABIES UPDATES

The fifth World Rabies Day will be on September 28, 2011. More information is available at: http://www.worldrabiesday.org.

The 22nd annual international conference on Rabies in the Americas (RITA) is scheduled for October 16-21, 2011 in San Juan, Puerto Rico. More information is available at: http://www.rabiesintheamericas.org/.

CDC's Rabies Laboratory is attempting to collect specimens to evaluate the potential for rabies transmission via milk from lactating animals. Over the past 15 years, CDC has received mammary tissue and unpasteurized milk from approximately 1 rabid cow per year. To date, no rabies virus antigen or nucleic acids have been detected. However, continued collection of appropriate samples is critical to obtain a sufficient sample size to make evidence based recommendations. When rabies is suspected in a lactating animal, milk and mammary tissue should be collected and stored. If rabies is diagnosed, the milk and mammary tissue should be shipped on dry ice to:

Dr. Charles E. Rupprecht
DASH, Building 18, Room SSB218
Centers for Disease Control and Prevention
1600 Clifton Road, NE
Atlanta, GA 30333
(404) 639-1050

Enhanced surveillance of the rabies virus variants currently circulating in the U.S. is critical for detecting new or introduced rabies virus variants. CDC requests an aliquot of CNS tissue from: rabid domestic animals (especially dogs); less common non-reservoir species (e.g. ruminants); and, from rabid carnivores in areas where bats are the only enzootic rabies reservoir, for antigenic and phylogenetic characterization. In addition, to better evaluate the potential of certain species groups to transmit rabies, the entire head of any rodent or lagomorph testing positive for rabies should be submitted to evaluate the presence of rabies virus in salivary glands. Where feasible, rabies diagnostic laboratories should store the heads of highly suspect rodents and lagomorphs until testing is completed. Positive specimens should be sent to CDC at the above address for further analysis.

Compendium of Animal Rabies Prevention and Control, 2011*

National Association of State Public Health Veterinarians, Inc. (NASPHV)

Rabies is a fatal viral zoonosis and a serious public health problem *(1).* All mammals are believed to be susceptible to the disease, and for purposes of this document, use of the term "animal" refers to mammals. The disease is an acute, progressive encephalitis caused by a lyssavirus. Rabies virus is the most important lyssavirus globally. In the United States, multiple rabies virus variants are maintained in wild mammalian reservoir populations such as raccoons, skunks, foxes, and bats. Although the U.S. has been declared free of canine rabies virus variant transmission, there is always a risk of reintroduction of these variants *(2-6).*

The virus is usually transmitted from animal to animal through bites. The incubation period is highly variable. In domestic animals it is generally 3-12 weeks, but can range from several days to months, rarely exceeding 6 months *(7)*. Rabies is communicable during the period of salivary shedding of rabies virus. Experimental and historic evidence document that dogs, cats, and ferrets shed virus a few days prior to clinical onset and during illness. Clinical signs of rabies are variable and include inappetance, dysphagia, cranial nerve deficits, abnormal behavior, ataxia, paralysis, altered vocalization, and seizures. Progression to death is rapid. There are currently no known effective rabies antiviral drugs.

The recommendations in this compendium serve as a basis for animal rabies prevention and control programs throughout the United States and facilitate standardization of procedures among jurisdictions, thereby contributing to an effective national rabies control program. This document is reviewed and revised as necessary. The most current version replaces all previous versions. These recommendations do not supersede state and local laws or requirements. Principles of rabies prevention and control are detailed in Part I; recommendations for parenteral vaccination procedures are presented in Part II; and all animal rabies vaccines licensed by the United States Department of Agriculture (USDA) and marketed in the United States are listed and described in Part III.

The NASPHV Committee
Catherine M. Brown, DVM, MSc, MPH, Chair
Lisa Conti, DVM, MPH
Paul Ettestad, DVM, MS
Mira J. Leslie, DVM, MPH
Faye E. Sorhage, VMD, MPH
Ben Sun, DVM, MPVM

Consultants to the Committee
Donald Hoenig, VMD; AVMA
Donna M. Gatewood, DVM, MS; USDA Center for Veterinary Biologics
Lorraine Moule; NACA
Barbara Nay; Animal Health Institute
Raoult Ratard, MD, MS, MPH; CSTE
Charles E. Rupprecht, VMD, MS, PhD; CDC
Dennis Slate, MS, PhD; USDA Wildlife Services
James Powell, MS; APHL
Burton Wilcke, Jr., PhD; APHA

***Address all correspondence to:**
Catherine M. Brown, DVM, MSc, MPH
State Public Health Veterinarian
Massachusetts Department of Public Health
Hinton State Laboratory Institute,
305 South St.
Jamaica Plain, MA 02130

Endorsed by:
American Public Health Association (APHA)
American Veterinary Medical Association (AVMA)
Association of Public Health Laboratories (APHL)
Council of State and Territorial Epidemiologists (CSTE)
National Animal Control Association (NACA)

Part I. Rabies Prevention and Control

A. PRINCIPLES OF RABIES PREVENTION AND CONTROL

1. CASE DEFINITION: An animal is determined to be rabid after diagnosis by a qualified laboratory as specified in Part I.A.9. The national case definition for animal rabies requires laboratory confirmation by either:

- A positive direct fluorescent antibody test (preferably performed on central nervous system tissue); or
- Isolation of rabies virus (in cell culture or in a laboratory animal *(8)*.

2. RABIES EXPOSURE: Rabies is transmitted when the virus is introduced into bite wounds, open cuts in skin, or onto mucous membranes from saliva or other potentially infectious material such as neural tissue *(9)*. Questions regarding possible exposures should be directed promptly to state or local public health authorities.

3. PUBLIC HEALTH EDUCATION: Essential components of rabies prevention and control include ongoing public education, responsible pet ownership, routine veterinary care and vaccination, and professional continuing education. The majority of animal and human exposures to rabies can be prevented by raising awareness concerning: rabies transmission routes, avoiding contact with wildlife, and following appropriate veterinary care. Prompt recognition and reporting of possible exposures to medical professionals and local public health authorities is critical.

4. HUMAN RABIES PREVENTION: Rabies in humans can be prevented either by eliminating exposures to rabid animals or by providing exposed persons with prompt local treatment of wounds combined with the appropriate administration of human rabies immune globulin and vaccine. Exposure assessment should occur before postexposure rabies prophylaxis (PEP) is initiated and should include discussion between medical providers and public health officials. The rationale for recommending preexposure prophylaxis and details of both pre- and post-exposure prophylaxis administration can be found in the current recommendations of the Advisory Committee on Immunization Practices (ACIP) *(9,10)*. These recommendations, along with information concerning the current local and regional epidemiology of animal rabies and the availability of human rabies biologics, are available from state health departments.

5. DOMESTIC ANIMAL VACCINATION: Multiple vaccines are licensed for use in domestic animal species. Vaccines available include: inactivated or modified live virus vectored products; products for intramuscular and subcutaneous administration; products with durations of immunity from one to 4 years; and products with varying minimum age of vaccination. The recommended vaccination procedures and the licensed animal vaccines are specified in Parts II and III of this compendium, respectively. Local governments should initiate and maintain effective programs to ensure vaccination of all dogs, cats, and ferrets and to remove strays and unwanted animals. Such procedures in the United States have reduced laboratory confirmed cases of rabies in dogs from 6,949 in 1947 to 93 in 2009 *(2)*. Because more rabies cases are reported annually involving cats (274 in 2009) than dogs, vaccination of cats should be required *(2)*. Animal shelters and animal control authorities should establish policies to ensure that adopted animals are vaccinated against rabies.

6. RABIES IN VACCINATED ANIMALS: Rabies is rare in vaccinated animals *(11-13)*. If such an event is suspected, it should be reported to public health officials; the vaccine manufacturer; and USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255). The laboratory diagnosis should be confirmed and the virus variant characterized by the Centers for Disease Control and Prevention (CDC) rabies reference laboratory. A thorough epidemiologic investigation

including documentation of the animal's vaccination history and a description of potential rabies exposures should be conducted.

7. RABIES IN WILDLIFE: The control of rabies among wildlife reservoirs is difficult *(14)*. Vaccination of free-ranging wildlife or selective population reduction is useful in some situations *(15)*, but the success of such procedures depends on the circumstances surrounding each rabies outbreak (see Part I. C.). Because of the risk of rabies in wild animals (especially raccoons, skunks, coyotes, foxes, and bats), the American Veterinary Medical Association, American Public Health Association, Council of State and Territorial Epidemiologists, National Animal Control Association and the National Association of State Public Health Veterinarians strongly recommend the enactment and enforcement of state laws prohibiting their importation, distribution, translocation, and private ownership.

8. RABIES SURVEILLANCE: Enhanced laboratory-based rabies surveillance and variant typing are essential components of rabies prevention and control programs. Accurate and timely information and reporting is necessary to: guide human PEP decisions; determine the management of potentially exposed animals; aid in emerging pathogen discovery; describe the epidemiology of the disease; and assess the need for and effectiveness of vaccination programs for domestic animals and wildlife. Every animal submitted for rabies testing should be reported to CDC to evaluate surveillance trends. Electronic laboratory reporting and notification of animal rabies surveillance data should be implemented *(16)*. Optimal information on animals submitted for rabies testing should include species, point location, vaccination history, rabies virus variant (if rabid), and human or domestic animal exposures. Rabid animals with a history of importation within 60 days into the United States are immediately notifiable by state health departments to CDC; all indigenous cases should follow standard notification protocols *(17)*. Integration with standard public health reporting and notification systems should facilitate the transmission of the above data elements.

9. RABIES DIAGNOSIS:

a) The direct fluorescent antibody (DFA) test is the gold standard for rabies diagnosis. The DFA test should be performed in accordance with the established national standardized protocol (http://www.cdc.gov/rabies/docs/standard_dfa_protocol_rabies.pdf) by a qualified laboratory that has been designated by the local or state health department *(18,19)*. Animals submitted for rabies testing should be euthanized *(20,21)* in such a way as to maintain the integrity of the brain so that the laboratory can recognize the anatomical parts. Except in the case of very small animals, such as bats, only the head or brain (including brain stem) should be submitted to the laboratory. To facilitate prompt laboratory testing, submitted specimens should be stored and shipped under refrigeration without delay. The need to thaw frozen specimens will delay testing. Chemical fixation of tissues should be avoided to prevent significant testing delays and because it might preclude reliable testing. Questions about testing of fixed tissues should be directed to the local rabies laboratory or public health department.

b) Rabies testing should be available on an emergency basis to expedite exposure management decisions *(18)*. When confirmatory testing is needed by state health departments (e.g., inconclusive results, unusual species, mass exposures), the CDC rabies laboratory can provide results within 24 hours of submission *(22)*.

c) A direct rapid immunohistochemical test (DRIT) is being used by trained field personnel in surveillance programs for specimens not involved in human or domestic animal exposures *(23-26)*. All positive DRIT results need to be confirmed by DFA testing at a qualified laboratory.

d) Currently, there are no USDA licensed rapid test kits commercially available for rabies diagnosis. Unlicensed tests should not be used due to several concerns: the sensitivity/specificity are not known; the tests have not been validated against current standard methods; the excretion of virus in the saliva is intermittent and the amount varies over time; any test result would need to be confirmed by more

reliable methods such as DFA testing on brain tissue; and the interpretation of results may place exposed animals and persons at risk.

10. RABIES SEROLOGY: Some jurisdictions require evidence of vaccination and rabies virus antibodies for animal importation purposes. Rabies virus antibody titers are indicative of a response to vaccine or infection. Titers do not directly correlate with protection because other immunologic factors also play a role in preventing rabies, and our abilities to measure and interpret those other factors are not well-developed. Therefore, evidence of circulating rabies virus antibodies in animals should not be used as a substitute for current vaccination in managing rabies exposures or determining the need for booster vaccinations *(27-30)*.

11. RABIES RESEARCH: Information derived from well-designed studies is essential for the development of science-based recommendations. Data are needed in several areas including: viral shedding periods for domestic livestock and lagomorphs; potential shedding of virus in milk; earliest age at which rabies vaccination is effective and protective effect of maternal antibody; duration of immunity; postexposure prophylaxis protocols for domestic animals; models for treatment of clinical rabies; extra label vaccine use in domestic animals and wildlife rabies reservoirs; host-pathogen adaptations and dynamics; and the ecology of wildlife rabies reservoir species, especially in relation to the use of oral rabies vaccines.

B. PREVENTION AND CONTROL METHODS IN DOMESTIC AND CONFINED ANIMALS

1. PREEXPOSURE VACCINATION AND MANAGEMENT: Parenteral animal rabies vaccines should be administered only by or under the direct supervision of a licensed veterinarian on premises. Rabies vaccinations may also be administered under the supervision of a licensed veterinarian to animals held in animal control shelters before release. The veterinarian signing a rabies vaccination certificate must ensure that the person administering vaccine is identified on the certificate and is appropriately trained in vaccine storage, handling, administration, and in the management of adverse events. This practice assures that a qualified and responsible person can be held accountable for properly vaccinating the animal. Within 28 days after initial vaccination, a peak rabies virus antibody titer is reached, and the animal can be considered immunized *(29,31-33)*. An animal is currently vaccinated and is considered immunized if the initial vaccination was administered at least 28 days previously or booster vaccinations have been administered in accordance with this compendium.

Regardless of the age of the animal at initial vaccination, a booster vaccination should be administered 1 year later (see Parts II and III for vaccines and procedures). No laboratory or epidemiologic data exist to support the annual or biennial administration of 3- or 4-year vaccines after the initial series. Because a rapid anamnestic response is expected, an animal is considered currently vaccinated immediately after a booster vaccination *(34)*.

a) DOGS, CATS AND FERRETS

All dogs, cats, and ferrets should be vaccinated against rabies and revaccinated in accordance with Part III of this compendium. If a previously vaccinated animal is overdue for a booster, it should be revaccinated. Immediately after the booster, the animal is considered currently vaccinated and should be placed on a booster schedule, depending on the labeled duration of the vaccine used.

b) LIVESTOCK

All horses should be vaccinated against rabies *(35)*. Livestock, including species for which licensed vaccines are not available, that have frequent contact with humans (e.g., in petting zoos, fairs, and other public exhibitions) should be vaccinated against rabies *(36,37)*. Consideration should also be given to vaccinating livestock that are particularly valuable.

c) CAPTIVE WILD ANIMALS AND HYBRIDS (the offspring of wild animals crossbred to domestic animals).

(1) Wild animals or hybrids should not be kept as pets *(38-40)*. No parenteral rabies vaccines are licensed for use in wild animals or hybrids *(41)*.

(2) Animals that are maintained in exhibits and in zoological parks and are not completely excluded from all contact with rabies vectors can become infected. Moreover, wild animals might be incubating rabies when initially captured; therefore, wild-caught animals susceptible to rabies should be quarantined for a minimum of 6 months. Employees who work with animals at such facilities should receive preexposure rabies vaccination. The use of pre- or postexposure rabies vaccinations for handlers who work with animals at such facilities might reduce the need for euthanasia of captive animals that expose handlers. Carnivores and bats should be housed in a manner that precludes direct contact with the public *(36,37)*.

2. STRAY ANIMALS: Stray dogs, cats, and ferrets should be removed from the community. Local health departments and animal control officials can enforce the removal of strays more effectively if owned animals are required to have identification and are confined or kept on leash. Strays should be impounded for at least 3 business days to determine if human exposure has occurred and to give owners sufficient time to reclaim animals.

3. IMPORTATION AND INTERSTATE MOVEMENT OF ANIMALS:

a) INTERNATIONAL. CDC regulates the importation of dogs and cats into the United States (*5*). Importers of dogs must comply with rabies vaccination requirements (42 CFR, Part 71.51[c] [http://www.cdc.gov/animalimportation/dogs.html]) and complete CDC form 75.37 (http://www.cdc.gov/animalimportation/pdf/dog-import.pdf). These regulations require dogs imported from rabies endemic countries to be vaccinated for rabies and confined for varying timeframes depending on age, prior vaccination status, and country of origin. The appropriate health official of the state of destination should be notified within 72 hours of the arrival of any imported dog required to be placed in confinement under these regulations. Failure of the owner to comply with these confinement requirements should be promptly reported to the Division of Global Migration and Quarantine, CDC (telephone: 404-639-4528 or 404-639-4537).

Federal regulations alone are insufficient to prevent the introduction of rabid animals into the United States *(3,4,42,43)*. All imported dogs and cats are subject to state and local laws governing rabies and should be currently vaccinated against rabies in accordance with this compendium. Failure of the owner to comply with state or local requirements should be referred to the appropriate state or local official.

b) AREAS WITH DOG-TO-DOG RABIES TRANSMISSION. Canine rabies virus variants have been eliminated in the United States *(2,6)*. Rabid dogs have been introduced into the continental United States from areas with dog-to-dog rabies transmission *(3,4,42,43)*. The movement of dogs for the purposes of adoption or sale from areas with dog-dog rabies transmission increases the risk of introducing canine-transmitted rabies to areas where it does not currently exist and should be prohibited.

c) INTERSTATE. Before interstate (including commonwealths and territories) movement, dogs, cats, ferrets, and horses should be currently vaccinated against rabies in accordance with this compendium's recommendations (see Part I. B.1.). Animals in transit should be accompanied by a currently valid NASPHV Form 51, Rabies Vaccination Certificate (http://www.nasphv.org/Documents/RabiesVacCert.pdf). When an interstate health certificate or certificate of veterinary inspection is required, it should contain the same rabies vaccination information as Form 51.

4. ADJUNCT PROCEDURES: Methods or procedures that enhance rabies control include the following (http://www.rabiesblueprint.com/spip.php?article119):

a) IDENTIFICATION. Dogs, cats, and ferrets should be identified (e.g., metal or plastic tags or microchips) to allow for verification of rabies vaccination status.

b) LICENSURE. Registration or licensure of all dogs, cats, and ferrets is an integral component of an effective rabies control program. A fee is frequently charged for such licensure, and revenues collected are used to maintain rabies or animal control activities. Evidence of current vaccination should be an essential prerequisite to licensure.

c) CANVASSING. House-to-house canvassing by animal control officials facilitates enforcement of vaccination and licensure requirements.

d) CITATIONS. Citations are legal summonses issued to owners for violations, including the failure to vaccinate or license their animals. The authority for officers to issue citations should be an integral part of each animal control program.

e) ANIMAL CONTROL. All local jurisdictions should incorporate stray animal control, leash laws, animal bite prevention, and training of personnel in their programs.

f) PUBLIC EDUCATION. All local jurisdictions should incorporate education covering responsible pet ownership, bite prevention, and appropriate veterinary care in their programs.

5. POSTEXPOSURE MANAGEMENT: This section refers to any animal exposed (see Part I.A.2.) to a confirmed or suspected rabid animal. Wild mammalian carnivores or bats that are not available or suitable for testing should be regarded as rabid animals.

a) DOGS, CATS AND FERRETS. Any illness in an exposed animal should be reported immediately to the local health department. If signs suggestive of rabies develop (e.g., paralysis, seizures, etc.), the animal should be euthanized and the head shipped for testing as described in Part I.A.9.

(1) Dogs, cats, and ferrets that have never been vaccinated and are exposed to a rabid animal should be euthanized immediately. If the owner is unwilling to have this done, the animal should be placed in strict isolation for 6 months. Isolation in this context refers to confinement in an enclosure that precludes direct contact with people and other animals. Rabies vaccine should be administered upon entry into isolation or up to 28 days before release to comply with preexposure vaccination recommendations (see Part I.B.1.a.). There are currently no USDA licensed biologics for postexposure prophylaxis of previously unvaccinated domestic animals, and there is evidence that the use of vaccine alone will not reliably prevent the disease in these animals *(44)*.

(2) Animals overdue for a booster vaccination should be evaluated on a case-by-case basis based upon 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 revaccination and observation/isolation.

(3) Dogs, cats, and ferrets that are currently vaccinated should be revaccinated immediately, kept under the owner's control, and observed for 45 days. The rationale for an observation period is based in part on the potential for: overwhelming viral challenge, incomplete vaccine efficacy, improper vaccine administration, variable host immunocompetence, and immune-mediated fatality (i.e., early death phenomenon) *(12,45-47)*.

b) LIVESTOCK. All species of livestock are susceptible to rabies; cattle and horses are the most frequently reported infected species *(2)*. Any illness in an exposed animal should be reported immediately to the local health and agriculture officials. If signs suggestive of rabies develop, the animal should be euthanized and the head shipped for testing as described in Part I.A.9.

(1) Unvaccinated livestock should be euthanized immediately. If the animal is not euthanized, it should be observed and confined on a case-by-case basis for 6 months.

(2) Livestock exposed to a rabid animal and currently vaccinated with a vaccine approved by USDA for that species should be revaccinated immediately and observed for 45 days.

(3) Multiple rabid animals in a herd or herbivore-to-herbivore transmission are uncommon *(48)*; therefore, restricting the rest of the herd if a single animal has been exposed to or infected by rabies is usually not necessary.

(4) Handling and consumption of tissues from exposed animals might carry a risk for rabies transmission. Risk factors depend in part on the site(s) of exposure, amount of virus present, severity of wounds, and whether sufficient contaminated tissue has been excised. If an exposed animal is to be custom or home-slaughtered for consumption, it should be done immediately after exposure, and all tissues should be cooked thoroughly. Persons handling exposed animals, carcasses, and tissues should use barrier precautions *(49,50)*. Historically, federal guidelines for meat inspectors required that any animal known to have been exposed to rabies within 8 months be rejected for slaughter *(51)*. USDA Food and Inspection Service (FSIS) and state meat inspectors should be notified if such exposures occur in food animals before slaughter.

Rabies virus is widely distributed in tissues of rabid animals *(52-54)*. Tissues and products from a rabid animal should not be used for human or animal consumption *(55,56)* or transplantation *(57)*. Pasteurization and cooking will inactivate rabies virus *(58)*; therefore, inadvertently drinking pasteurized milk or eating thoroughly cooked animal products does not constitute a rabies exposure.

c) 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 in consultation with public health authorities. Management options may include isolation, observation, or administration of rabies biologics.

6. MANAGEMENT OF ANIMALS THAT BITE HUMANS:

a) Dogs, Cats, and Ferrets. Rabies virus is excreted in the saliva of infected dogs, cats, and ferrets during illness and/or for only a few days before illness or death *(59-61)*. Regardless of rabies vaccination status, a healthy dog, cat, or ferret that exposes a person should be confined and observed daily for 10 days from the time of the exposure *(62)*; administration of rabies vaccine to the animal is not recommended during the observation period to avoid confusing signs of rabies with rare adverse reactions *(13)*. Any illness in the animal should be reported immediately to the local health department. Such animals should be evaluated by a veterinarian at the first sign of illness during confinement. If signs suggestive of rabies develop, the animal should be euthanized and the head submitted for testing as described in Part I.A.9. Any stray or unwanted dog, cat, or ferret that exposes a person may be euthanized immediately and the head submitted for rabies examination.

b) Other Animals. 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, 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.

7. OUTBREAK PREVENTION AND CONTROL. The emergence of new rabies virus variants or the introduction of non-indigenous viruses poses a significant risk to humans, domestic animals, and wildlife *(63-70)*. A rapid and comprehensive response includes the following measures *(71)*:

a) Characterize the virus at the national reference laboratory.
b) Identify and control the source of the introduction.
c) Enhance laboratory-based surveillance in wild and domestic animals.
d) Increase animal rabies vaccination rates.
e) Restrict the movement of animals.
f) Evaluate the need for vector population reduction.
g) Coordinate a multiagency response.
h) Provide public and professional outreach and education.

8. DISASTER RESPONSE: Animals might be displaced during and after man-made or natural disasters and require emergency sheltering (http://www.bt.cdc.gov/disasters/petshelters.asp and http://www.avma.org/disaster/default.asp) *(72)*. Animal rabies vaccination and exposure histories often are not available for displaced animals. Disaster response creates situations where animal caretakers might lack appropriate training and preexposure vaccination. In such situations, it is critical to implement and coordinate rabies prevention and control measures to reduce the risk of rabies transmission and the need for human PEP. Such measures include actions to:

a) Coordinate relief efforts of individuals and organizations with the local emergency operations center before deployment.
b) Examine each animal at a triage site for possible bite injuries or signs of rabies.
c) Isolate animals exhibiting signs of rabies, pending evaluation by a veterinarian.
d) Ensure that all animals have a unique identifier.
e) Administer a rabies vaccination to all dogs, cats and ferrets unless reliable proof of vaccination exists.
f) Adopt minimum standards for animal caretakers as feasible, including personal protective equipment, preexposure rabies vaccination, and appropriate training in animal handling *(73)*.
g) Maintain documentation of animal disposition and location (e.g., returned to owner, died or euthanized, adopted, relocated to another shelter, and address of new location).
h) Provide facilities to confine and observe animals involved in exposures (see Part I.B.6.).
i) Report human exposures to appropriate public health authorities (see Part I.A.3.).

C. PREVENTION AND CONTROL METHODS RELATED TO WILDLIFE

The public should be warned not to handle or feed wild mammals. Wild mammals and hybrids that expose persons, pets, or livestock should be considered for euthanasia and rabies diagnosis. A person exposed by any wild mammal should immediately report the incident to a healthcare provider who, in consultation with public health authorities, can evaluate the need for PEP (*9,10)*.

Translocation of infected wildlife has contributed to the spread of rabies *(63-68,74)*; therefore, the translocation of known terrestrial rabies reservoir species should be prohibited. Whereas state regulated wildlife rehabilitators and nuisance wildlife control operators may play a role in a comprehensive rabies control program, minimum standards for persons who handle wild mammals should include rabies vaccination, appropriate training, and continuing education.

1. CARNIVORES: The use of oral rabies vaccines (ORV) for the mass vaccination of free-ranging wildlife should be considered in selected situations, with the approval of the appropriate state agencies *(14,75)*. There have been documented successes using ORV to control rabies in wildlife in North America *(75-78)*. The currently licensed vaccinia-vectored ORV is labeled for use in raccoons and coyotes. The distribution of ORV should be based on scientific assessments of the target species and followed by timely and appropriate analysis of surveillance data; such results should be provided to all stakeholders. In addition, parenteral vaccination (trap-vaccinate-release) of wildlife rabies reservoirs may be integrated into coordinated ORV programs to enhance their effectiveness. Continuous and persistent programs for trapping

or poisoning wildlife are not effective in reducing wildlife rabies reservoirs on a statewide basis. However, limited population control in high-contact areas (e.g., picnic grounds, camps, and suburban areas) might be indicated for the removal of selected high-risk species of wildlife. State agriculture, public health, and wildlife agencies should be consulted for planning, coordination, and evaluation of vaccination or population reduction programs *(14)*.

2. BATS: From the 1950's to date, indigenous rabid bats have been reported from every state except Hawaii and have caused rabies in at least 43 humans in the United States *(79-92)*. Bats should be excluded appropriately from houses, public buildings, and adjacent structures to prevent direct association with humans *(93,94)*. Such structures should then be made bat-proof by sealing entrances used by bats. Controlling rabies in bats through programs designed to reduce bat populations is neither feasible nor desirable.

Part II. Recommendations for Parenteral Rabies Vaccination Procedures

A. VACCINE ADMINISTRATION: All animal rabies vaccines should be restricted to use by or under the direct supervision of a veterinarian *(95)*, except as recommended in Part I.B.1.

B. VACCINE SELECTION: Part III lists all vaccines licensed by USDA and marketed in the United States at the time of publication. New vaccine approvals or changes in label specifications made subsequent to publication should be considered as part of this list. Any of the listed vaccines can be used for revaccination, even if the product is not the same as previously administered. Vaccines used in state and local rabies control programs should have at least a 3-year duration of immunity. This constitutes the most effective method of increasing the proportion of immunized dogs and cats in any population *(96)*. No laboratory or epidemiologic data exist to support the annual or biennial administration of 3- or 4-year vaccines following the initial series.

C. ADVERSE EVENTS: Currently, no epidemiologic association exists between a particular licensed vaccine product and adverse events *(13,97-98)*. Although rare, adverse events including vomiting, injection site swelling, lethargy, hypersensitivity, and rabies in a previously vaccinated animal have been reported. Adverse events should be reported to the vaccine manufacturer and to USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255). No contraindication to rabies vaccination exists. Animals with a previous history of anaphylaxis can be medically managed and observed after vaccination *(46)*.

D. WILDLIFE AND HYBRID ANIMAL VACCINATION: The safety and efficacy of parenteral rabies vaccination of wildlife and hybrids have not been established, and no rabies vaccines are licensed for these animals. Zoos or research institutions may establish vaccination programs to attempt to protect valuable animals, but these should not replace appropriate public health activities that protect humans (see Part I.B.1.c.2).

E. ACCIDENTAL HUMAN EXPOSURE TO VACCINE: Human exposure to parenteral animal rabies vaccines listed in Part III does not constitute a risk for rabies virus infection. Human exposure to vaccinia-vectored oral rabies vaccines should be reported to state health officials *(100,101)*.

F. RABIES CERTIFICATE: All agencies and veterinarians should use NASPHV Form 51 (revised 2007), Rabies Vaccination Certificate, or an equivalent. This form can be obtained from vaccine manufacturers, NASPHV (http://www.nasphv.org/Documents/RabiesVacCert.pdf), or CDC (http://www.cdc.gov/rabies/pdf/nasphv_form51.pdf). The form must be completed in full and signed by the administering or supervising veterinarian. Computer generated forms containing the same information are also acceptable.

III.Rabies Vaccines Licensed and Marketed in the U.S., 2011

Product Name	Produced by	Marketed by	For Use In	Dosage	Age at Primary Vaccination[a]	Booster Recommended	Route of Inoculation
A) MONOVALENT (Inactivated)							
RABVAC 1	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs Cats	1 ml 1 ml	3 months[b] 3 months	Annually Annually	IM[c] or SC[d] IM or SC
RABVAC 3	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs Cats Horses	1 ml 1 ml 2 ml	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC IM
RABVAC 3 TF	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs Cats Horses	1 ml 1 ml 2 ml	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC IM
CONTINUUM RABIES	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	1 year later & triennially 1 year later & quadrennially	SC SC
EQUI-RAB	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Horses	1 ml	4 months	Annually	IM
PRORAB-1	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Dogs Cats Sheep	1 ml 1 ml 2 ml	3 months 3 months 3 months	Annually Annually Annually	IM or SC IM or SC IM
DEFENSOR 1	Pfizer, Incorporated License No. 189	Pfizer, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	IM or SC SC
DEFENSOR 3	Pfizer, Incorporated License No. 189	Pfizer, Incorporated	Dogs Cats Sheep Cattle	1 ml 1 ml 2 ml 2 ml	3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually Annually	IM or SC SC IM IM
RABDOMUN	Pfizer, Incorporated License No. 189	Schering-Plough Animal Health	Dogs Cats Sheep Cattle	1 ml 1 ml 2 ml 2 ml	3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually Annually	IM or SC SC IM IM
RABDOMUN 1	Pfizer, Incorporated License No. 189	Schering-Plough Animal Health	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	IM or SC SC
IMRAB 1	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	SC SC
IMRAB 1 TF	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	SC SC
IMRAB 3	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats Sheep Cattle Horses Ferrets	1 ml 1 ml 2 ml 2 ml 2 ml 1 ml	3 months 3 months 3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially 1 year later & triennially Annually Annually Annually	IM or SC IM or SC IM or SC IM or SC IM or SC SC
IMRAB 3 TF	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats Ferrets	1 ml 1 ml 1 ml	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC SC
IMRAB Large Animal	Merial, Incorporated License No. 298	Merial, Incorporated	Cattle Horses Sheep	2 ml 2 ml 2 ml	3 months 3 months 3 months	Annually Annually 1 year later & triennially	IM or SC IM or SC IM or SC
B) MONOVALENT (Rabies glycoprotein, live canary pox vector)							
PUREVAX Feline Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	3 months	Annually	SC
C) COMBINATION (Inactivated rabies)							
CONTINUUM DAP-R	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Dogs	1 ml	3 months	1 year later & triennially	SC
CONTINUUM Feline HCP-R	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Cats	1 ml	3 months	1 year later & triennially	SC
Equine POTOMAVAC + IMRAB	Merial, Incorporated License No. 298	Merial, Incorporated	Horses	1 ml	3 months	Annually	IM
D) COMBINATION (Rabies glycoprotein, live canary pox vector)							
PUREVAX Feline 3/ Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	8 weeks 3 months	Every 3 weeks until 3 months & annually 3 weeks later & annually	SC
PUREVAX Feline 4/ Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	8 weeks 3 months	Every 3 weeks until 3 months & annually 3 weeks later & annually	SC
E) ORAL (Rabies glycoprotein, live vaccinia vector) - RESTRICTED TO USE IN STATE AND FEDERAL RABIES CONTROL PROGRAMS							
RABORAL V-RG	Merial, Incorporated License No. 298	Merial, Incorporated	Coyotes Raccoons	N/A	N/A	As determined by local authorities	Oral

a. Minimum age (or older) and revaccinated one year later
b. One month = 28 days
c. Intramuscularly
d. Subcutaneously
e. Fort Dodge Animal Health was recently acquired by Boehringer Ingelheim Vetmedica, Inc.

Rabies Vaccine Manufacturer Contact Information

Manufacturer	Phone Number	Internet Address
Boehringer Ingelheim Vetmedica, Inc.	800-638-2226	Not available
Intervet, Inc.	800-441-8272	http://www.intervetusa.com
Merial, Inc.	888-637-4251	http://us.merial.com
Pfizer, Inc.	800-366-5288	http://www.pfizerah.com

ADVERSE EVENTS: Adverse events should be reported to the vaccine manufacturer and to USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255;).

REFERENCES:

1. Rabies. In: Heymann D, ed. Control of communicable diseases manual. 19th ed. Washington, DC: American Public Health Association; 2008:498-508.
2. Blanton JD, Palmer D, Christian KA, Rupprecht CE. Rabies surveillance in the United States during 2009. J Am Vet Med Assn 2010;237(6):646-657. Available at: http://www.cdc.gov/rabies/resources/publications/index.html.
3. Castrodale L, Walker V, Baldwin J, Hofmann J, Hanlon C. Rabies in a puppy imported from India to the USA, March 2007. Zoonoses Public Health 2008;55(8-10):427-430.
4. CDC. Rabies in a Dog Imported from Iraq -- New Jersey, June 2008. MMWR 2008; 57:1076-1078. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5739a3.htm.
5. McQuiston JH, Wilson T, Harris S, et al. Importation of dogs into the United States: risks from rabies and other zoonotic diseases. Zoonoses Public Health 2008;55(8-10):421-426.
6. Velasco-Villa A, Reeder SA, Orciari LA, et al. Enzootic rabies elimination from dogs and reemergence in wild terrestrial carnivores, United States. Emerg Infect Dis 2008;14(12):1849-1854. Available at: http://www.cdc.gov/EID/content/14/12/1849.htm.
7. Beran GW. Rabies and infections by rabies-related viruses. In: Beran GW (ed.) Handbook of zoonoses section B: Viral, second ed. Boca Raton, FL: CRC Press; 1994:307-57.
8. Council of State and Territorial Epidemiologists. Public Health Reporting and National Notification for Animal Rabies. Infectious Disease Positions Statements, June 2009. CSTE, Atlanta, GA. Available at: http://www.cste.org/ps2009/09-ID-12.pdf.
9. 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: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr57e507a1.htm.
10. CDC. Use of reduced (4-dose) vaccine schedule for postexposure prophylaxis to prevent human rabies. Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2010;59(No. RR-2):1-12. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5902a1.htm.
11. McQuiston J, Yager PA, Smith JS, Rupprecht CE. Epidemiologic characteristics of rabies virus variants in dogs and cats in the United States, 1999. J Am Vet Med Assoc 2001;218:1939–42.
12. Murray KO, Holmes KC, Hanlon CA. Rabies in vaccinated dogs and cats in the United States, 1997-2001. J Am Vet Med Assoc 2009;235:691-695.
13. Frana TS, Clough NE, Gatewood DM, Rupprecht CE. Postmarketing surveillance of rabies vaccines for dogs to evaluate safety and efficacy. J Am Vet Med Assoc 2008;232:1000-1002.
14. Hanlon CA, Childs JE, Nettles VF, et al. Recommendations of the Working Group on Rabies. Article III: rabies in wildlife. J Am Vet Med Assoc 1999;215:1612–8.
15. Slate D, Algeo TD, Nelson KM, et al. Oral rabies vaccination in North America: opportunities, complexities, and challenges. PLoS Negl Trop Dis 2009;3(12):1-9
16. Council of State and Territorial Epidemiologists. Electronic laboratory reporting in the US: underfunded and under potential, or, recommendations for the implementation of ELR in the US. Policy Positions Statements, June 2009. CSTE, Atlanta, GA. Available at: http://www.cste.org/ps2009/09-SI-03.pdf.
17. Council of State and Territorial Epidemiologists. Process statement for immediately nationally notifiable conditions. Policy Positions Statements, June 2009. CSTE, Atlanta, GA. Available at: http://www.cste.org/ps2009/09-SI-04.pdf.
18. Hanlon CA, Smith JS, Anderson GR, et al. Recommendations of the Working Group on Rabies. Article II: laboratory diagnosis of rabies. J Am Vet Med Assoc 1999;215:1444–6.
19. Rudd RJ, Smith JS, Yager PA, et al. A need for standardized rabies-virus diagnostic procedures: effect of cover-glass mountant on the reliability of antigen detection by the fluorescent antibody test. Virus Res 2005;111:83–8.
20. American Veterinary Medical Association. AVMA guidelines on euthanasia, June2007. Schaumburg, IL: American Veterinary Medical Association; 2007. Available at: http://www.avma.org/issues/animal_welfare/euthanasia.pdf.
21. Michigan Rabies Working Group. Humane euthanasia of bats for public health rabies testing. 2008. Available at: http://www.michigan.gov/documents/emergingdiseases/Humane_Euthanasia_of_Bats-Final_244979_7.pdf.
22. CDC. Public health response to a potentially rabid bear cub -- Iowa, 1999. MMWR 1999;48:971-3. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4842a5.htm.

23. Niezgoda M, Rupprecht CE. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention 1-16; 2006. Standard operating procedure for the direct rapid immunohistochemistry test for the detection of rabies virus antigen. National Laboratory Training Network Course. Available at: http://www.rabiesblueprint.com/IMG/pdf/DRIT_SOP.pdf.
24. Lembo T, Niezgoda M, Velasco-Villa A, Cleaveland S, Ernest E, Rupprecht CE. Evaluation of a direct, rapid immunohistochemical test for rabies diagnosis. Emerg Infect Dis. 2006. Feb;12(2):310-3.
25. Dürr S, Naïssengar S, Mindekem R, et al. Rabies diagnosis for developing countries. PLoS Negl Trop Dis. 2008. Mar 26;2(3):e206.
26. Saturday GA, King R, Fuhrmann L. Validation and operational application of a rapid method for rabies antigen detection. US Army Med Dep J. 2009. Jan-Mar:42-5.
27. Tizard I, Ni Y. Use of serologic testing to assess immune status of companion animals. J Am Vet Med Assoc 1998;213:54–60.
28. Greene CE, ed. Rabies and other lyssavirus infections. In: Infectious diseases of the dog and cat. 3rd ed. London, England: Saunders Elsevier; 2006;167–83.
29. Rupprecht CE, Gilbert J, Pitts R, Marshall K, Koprowski H. Evaluation of an inactivated rabies virus vaccine in domestic ferrets. J Am Vet Med Assoc 1990;196:1614–6.
30. Moore SM, Hanlon CA. Rabies-specific antibodies: measuring surrogates of protection against a fatal disease. PLoS Negl Trop Dis. 2010. Mar 9;4(3):e595.
31. Aubert MF. Practical significance of rabies antibodies in cats and dogs. Rev Sci Tech 1992;11:735–60.
32. Muirhead TL, McClure JT, Wichtel JJ, et al. The effect of age on serum antibody titers after rabies and influenza vaccination in healthy horses. J Vet Intern Med 2008;22:654-661.
33. Shimazaki Y, Inoue S, Takahashi C, et al. Immune response to Japanese rabies vaccine in domestic dogs. J Vet Med B 2003;50:95-8.
34. Cliquet F, Verdier Y, Sagné L, et al. Neutralising antibody titration in 25,000 sera of dogs and cats vaccinated against rabies in France, in the framework of the new regulations that offer an alternative to quarantine. Rev Sci Tech 2003;22:857–66.
35. Rabies. In: Guidelines for the vaccination of horses. American Association of Equine Practitioners; 2009. Available at: http://www.aaep.org/rabies.htm.
36. National Association of State Public Health Veterinarians. Compendium of measures to prevent disease and injury associated with animals in public settings, 2007. MMWR 2007;56(RR05);1-13. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5805a1.htm.
37. Bender J, Schulman S. Reports of zoonotic disease outbreaks associated with animal exhibits and availability of recommendations for preventing zoonotic disease transmission from animals to people in such settings. J Am Vet Med Assoc 2004;224:1105–9.
38. American Veterinary Medical Association. Private ownership of wild animals. Schaumburg, IL: American Veterinary Medical Association; 2006. Available at: http://www.avma.org/issues/policy/wild_animal_ownership.asp.
39. American Veterinary Medical Association. Position on canine hybrids. Schaumburg, IL: American Veterinary Medical Association; 2008. Available at: http://www.avma.org/issues/policy/canine_hybrids.asp.
40. Siino BS. Crossing the line: the case against hybrids. American Society for the Prevention of Cruelty to Animals, Animal Watch; 2000:22–9. Available at: http://www.petfinder.com/before-pet-adoption/case-against-hybrids.html?page-index=1&query=hybrids.
41. Jay MT, Reilly KF, DeBess EE, Haynes EH, Bader DR, Barrett LR. Rabies in a vaccinated wolf-dog hybrid. J Am Vet Med Assoc 1994;205:1729–32.
42. CDC. An imported case of rabies in an immunized dog. MMWR 1987;36:94–6. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00000874.htm.
43. CDC. Imported dog and cat rabies—New Hampshire, California. MMWR 1988;37:559–60. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00001275.htm.
44. Hanlon CA, Niezgoda MN, Rupprecht CE. Postexposure prophylaxis for prevention of rabies in dogs. Am J Vet Res 2002;63:1096–100.
45. US Government Printing Office. 9CFR113.209. Available at: http://edocket.access.gpo.gov/cfr_2003/9cfr113.209.htm.
46. Greene CE, ed. Immunoprophylaxis. In: Infectious diseases of the dog and cat. 3rd ed. London, England: Saunders Elsevier; 2006;1069-1119.
47. Willoughby, RE. “early death” and the contraindication of vaccine during rabies treatment. Vaccine 2009;27:7173-7177.
48. Mansfield K, McElhinney L, Hübschle O, et al. A molecular epidemiological study of rabies epizootics in kudu (Tragelaphus strepsiceros) in Namibia. BMC Vet Res 2006;2:2.
49. Viral agents. In: U.S. Department of Health and Human Services. Biosafety in Microbiological and Biomedical Laboratories. 5th edition. Washington, D.C.: U.S. Government Printing Office; 2007:234-235. Available at: http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5_sect_VIII_e.pdf.
50. Wertheim HFL, Nguyen TQ, Nguyen KAT, et al. Furious rabies after an atypical exposure. PLoS Med 2009;6(3):0264-8.
51. Ante-mortem inspection. In: U.S. Meat and Poultry Inspection Program. Meat and poultry inspection manual. Washington, D.C.: U.S. Government Printing Office; 1973:314 p.
52. Debbie JG, Trimarchi CV. Pantropism of rabies virus in free-ranging rabid red fox (*Vulpes fulva*). J Wildl Dis 1970;6(4):500-6.
53. Fekadu M, Shaddock JH. Peripheral distribution of virus in dogs inoculated with two strains of rabies virus. Am J Vet Res 1984;45(4):724-729.

54. Charlton, KM. The pathogenesis of rabies and other lyssaviral infections: recent studies. Curr Top Microbiol Immunol 1994;187:95–119.
55. Afshar, A. A review of non-bite transmission of rabies virus infection. Br Vet J 1979;135:142-8.
56. CDC. Mass treatment of humans who drank unpasteurized milk from rabid cows—Massachusetts, 1996–1998. MMWR 1999;48:228–9. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00056759.htm.
57. CDC. Public health service guideline on infectious disease issues in xenotransplantation. MMWR 2001;50(No. RR-15):1-56.
58. Turner GS, Kaplan C. Some properties of fixed rabies virus. J Gen Virol 1967;1:537-551.
59. Vaughn JB, Gerhardt P, Paterson J. Excretion of street rabies virus in saliva of cats. J Am Med Assoc 1963;184:705.
60. Vaughn JB, Gerhardt P, Newell KW. Excretion of street rabies virus in saliva of dogs. J Am Med Assoc 1965;193:363–8.
61. Niezgoda M, Briggs DJ, Shaddock J, Rupprecht CE. Viral excretion in domestic ferrets (Mustela putorius furo) inoculated with a raccoon rabies isolate. Am J Vet Res 1998;59:1629–32.
62. Tepsumethanon V, Lumlertdacha B, Mitmoonpitak C, Sitprija V, Meslin FX, Wilde H. Survival of naturally infected rabid dogs and cats. Clin Infect Dis 2004;39:278–80.
63. Jenkins SR, Perry BD, Winkler WG. Ecology and epidemiology of raccoon rabies. Rev Infect Dis 1988;10(Suppl 4):S620–5.
64. CDC. Translocation of coyote rabies—Florida, 1994. MMWR 1995;44:580–7. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00038451.htm.
65. Rupprecht CE, Smith JS, Fekadu M, Childs JE. The ascension of wildlife rabies: a cause for public health concern or intervention? Emerg Infect Dis 1995;1:107–14. Available at: http://www.cdc.gov/ncidod/eid/vol1no4/rupprech.htm.
66. Constantine DG. Geographic translocation of bats: known and potential problems. Emerg Infect Dis 2003;9:17–21. Available at: http://www.cdc.gov/ncidod/EID/vol9no1/02-0104.htm.
67. Krebs JW, Strine TW, Smith JS, Rupprecht CE, Childs JE. Rabies surveillance in the United States during 1993. J Am Vet Med Assoc 1994;2051695–709.
68. VF Nettles, JH Shaddock, RK Sikes, CR Reyes. Rabies in translocated raccoons. Am J Public Health 1979;69:601–2.
69. RM Engeman, KL Christensen, MJ Pipas, DL Bergman. Population monitoring in support of a rabies vaccination program for skunks in Arizona. J Wildl Dis 2003;39:746–50.
70. Leslie MJ, Messenger S, Rohde RE, et al. Bat-associated rabies virus in skunks. Emerg Infect Dis 2006;12:1274–7. Available at: http://www.cdc.gov/ncidod/EID/vol12no08/05-1526.htm.
71. Rupprecht CE, Hanlon CA, Slate D. Control and prevention of rabies in animals: paradigm shifts. Dev Biol (Basel). 2006;125:103-11.
72. Pets Evacuation and Transportations Standards Act of 2006. Available at: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_public_laws&docid=f:publ308.109.pdf.
73. National Animal Control Association guidelines. Available at: http://www.nacanet.org/guidelines.html.
74. Chipman R, Slate D, Rupprecht C, Mendoza M. Downside Risk of Translocation. Dodet B, Fooks AR, Muller T, Tordo N, and the Scientific & Technical Department of the OIE (eds): Towards the Elimination of Rabies in Eurasia. Dev Biol. Basel, Karger 2008;131:223-232.
75. Slate D, Rupprecht CE, Rooney JA, Donovan D, Lein DH, Chipman RB. Status of oral rabies vaccination in wild carnivores in the United States. Virus Res 2005;111:68–76.
76. Sidwa TJ, Wilson PJ, Moore GM, et al. Evaluation of oral rabies vaccination programs for control of rabies epizootics in coyotes and gray foxes: 1995-2003. J Am Vet Med Assoc 2005;227:785-792.
77. MacInnes CD, Smith SM, Tinline RR, et al. Elimination of rabies from red foxes in eastern Ontario. J Wildl Dis 2001;37:119-132.
78. Rosatte RC, Power MJ, Donovan D, et al. Elimination of arctic variant of rabies in red foxes, metropolitan Toronto. Emerg Infect Dis 2007;13(1)25-27. Available at: http://www.cdc.gov/ncidod/EID/13/1/25.htm.
79. Messenger SL, Smith JS, Rupprecht CE. Emerging epidemiology of bat-associated cryptic cases of rabies in humans in the United States. Clin Infect Dis 2002;35:738–47.
80. CDC. Human rabies—California, 2002. MMWR 2002;51:686–8. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5131a4.htm.
81. CDC. Human rabies—Tennessee, 2002. MMWR 2002;51:828–9. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5137a2.htm.
82. CDC. Human rabies—Iowa, 2002. MMWR 2003;52:47–8. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5203a3.htm.
83. CDC. Human death associated with bat rabies—California, 2003. MMWR 2004;53:33–5. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5302a4.htm.
84. CDC. Recovery of a patient from clinical rabies, Wisconsin, 2004. MMWR 2004;53:1171–3. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5350a1.htm.
85. CDC. Human rabies—Mississippi, 2005. MMWR 2006;55:207–8. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5508a4.htm.
86. CDC. Human rabies—Indiana and California, 2006. MMWR 2007;56:361–5. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5615a1.htm.
87. CDC. Human rabies—Minnesota, 2007. MMWR 2008;57:460-462. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5717a3.htm.

88. CDC. Human rabies—Missouri, 2008. MMWR 2009;58:1207-9. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5843a3.htm.
89. CDC. Human rabies—Kentucky/Indiana, 2009. MMWR 2010;59:393-6. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5913a3.htm.
90. CDC. Human rabies—Virginia, 2009. MMWR 2010;591236-8. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5938a3.htm.
91. CDC. Presumptive abortive human rabies—Texas, 2009. MMWR 2010;59:185-90. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5907a1.htm.
92. CDC. Human rabies-Michigan 2009. MMWR 2011;60:437-40. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6014a1.htm?s_cid=mm6014a1_w
93. Greenhall AM. House bat management. US Fish and Wildlife Service, Resource Publication 143;1982. Jamestown, ND: Northern Prairie Wildlife Research Center Online. Available at: http://www.npwrc.usgs.gov/resource/mammals/housebat/index.htm.
94. Greenhall, AM. Frantz, SC. Bats. In: Hygnstrom SE, Timm RM, Larson GE, eds. Prevention and Control of Wildlife Damage 1994. Available at: http://icwdm.org/handbook/mammals/bats.asp.
95. American Veterinary Medical Association. Model rabies control ordinance. Schaumburg, IL: American Veterinary Medical Association 2008. Available at: http://www.avma.org/issues/policy/AVMA-Model-Rabies-Ordinance.pdf.
96. Bunn TO. Canine and feline vaccines, past and present. In Baer GM, ed. The natural history of rabies. 2nd ed. Boca Raton, FL: CRC Press; 1991:415–25.
97. Macy DW, Hendrick MJ. The potential role of inflammation in the development of postvaccinal sarcomas in cats. Vet Clin North Am Small Anim Pract 1996;26:103–9.
98. Gobar GM, Kass PH. World wide web-based survey of vaccination practices, postvaccinal reactions, and vaccine site-associated sarcomas in cats. J Am Vet Med Assoc 2002;220:1477–82.
99. Kass PH, Spangler WL, Hendrick MJ, et al. Multicenter case-control study of risk factors associated with development of vaccine-associated sarcomas in cats. J Am Vet Med Assoc 2003;223:1283–92.
100. Rupprecht CE, Blass L, Smith K, et al. Human infection due to recombinant vaccinia-rabies glycoprotein virus. N Engl J Med 2001;345:582–6.
101. CDC. Human vaccinia infection after contact with a raccoon rabies vaccine bait— Pennsylvania, 2009. MMWR 2009; 58:1204-7. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5843a2.htm.

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

January 8, 1999 / Vol. 48 / No. RR-1

MMWR™

MORBIDITY AND MORTALITY WEEKLY REPORT

Recommendations and Reports

Inside: Continuing Education Examination

Human Rabies Prevention — United States, 1999

Recommendations of the Advisory Committee on Immunization Practices (ACIP)

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention (CDC)
Atlanta, Georgia 30333

The *MMWR* series of publications is published by the Epidemiology Program Office, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

SUGGESTED CITATION

Centers for Disease Control and Prevention. Human rabies prevention — United States, 1999: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48(No. RR-1):[inclusive page numbers].

Centers for Disease Control and Prevention ..... Jeffrey P. Koplan, M.D., M.P.H.
Director

The material in this report was prepared for publication by

National Center for Infectious Diseases..... James M. Hughes, M.D.
Director

Division of Viral and Rickettsial Diseases ..... Brian W.J. Mahy, Ph.D., Sc.D.
Director

The production of this report as an *MMWR* serial publication was coordinated in

Epidemiology Program Office..... Stephen B. Thacker, M.D., M.Sc.
Director

Office of Scientific and Health Communications .....John W. Ward, M.D.
Director
Editor, MMWR *Series*

Recommendations and Reports..... Suzanne M. Hewitt, M.P.A.
Managing Editor

Valerie R. Johnson
Project Editor

Morie M. Higgins
Visual Information Specialist

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

Copies can be purchased from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325. Telephone: (202) 512-1800.

Contents

Introduction 1
Rabies Biologics 2
Vaccines Licensed for Use in the United States 3
Human Diploid Cell Vaccine (HDCV) 3
Rabies Vaccine Adsorbed (RVA) 3
Purified Chick Embryo Cell Vaccine (PCEC) 3
Rabies Immune Globulin Licensed for Use in the United States 4
Primary or Preexposure Vaccination 4
Intramuscular Primary Vaccination 4
Intradermal Primary Vaccination 4
Preexposure Booster Doses of Vaccine 5
Postexposure Therapy for Previously Vaccinated Persons 6
Preexposure Vaccination and Serologic Testing 7
Postexposure Prophylaxis 7
Rationale for Treatment 7
Types of Exposure 8
Human-to-Human Transmission 8
Animal Rabies Epidemiology and Evaluation of Involved Species 9
Circumstances of Biting Incident and Vaccination Status of Exposing Animal 11
Treatment of Wounds and Immunization 11
Treatment of Wounds 11
Immunization 11
Treatment Outside the United States 13
Vaccination and Serologic Testing 14
Serologic Response Shortly After Vaccination 14
Serologic Response and Preexposure Booster Doses of Vaccine 14
Adverse Reactions 15
HDCV, RVA, and PCEC 15
Rabies Immune Globulin (Human) 15
Vaccines and Immune Globulins Used in Other Countries 15
Management of Adverse Reactions 16
Precautions and Contraindications 16
Immunosuppression 16
Pregnancy 17
Allergies 17
References 17
Insert: Continuing Education Activity CE-1

Advisory Committee on Immunization Practices Membership List, October 1998

CHAIRMAN
John F. Modlin, M.D.
Professor of Pediatrics and Medicine
Dartmouth Medical School
Lebanon, New Hampshire

EXECUTIVE SECRETARY
Dixie E. Snider, Jr., M.D., M.P.H.
Associate Director for Science
Centers for Disease Control and Prevention
Atlanta, Georgia

MEMBERS

Richard D. Clover, M.D.
University of Louisville School of Medicine
Louisville, Kentucky

David W. Fleming, M.D.
Oregon Health Division
Portland, Oregon

Mary P. Glode, M.D.
The Children's Hospital
Denver, Colorado

Marie R. Griffin, M.D., M.P.H.
Vanderbilt University Medicial Center
Nashville, Tennesse

Fernando A. Guerra, M.D.
San Antonio Metropolitan Health District
San Antonio, Texas

Charles M. Helms, M.D., Ph.D.
University of Iowa Hospital and Clinics
Iowa City, Iowa

David R. Johnson, M.D., M.H.P.
Michigan Department of Community Health
Lansing, Michigan

Chinh T. Le, M.D.
Kaiser Permanente Medical Center
Santa Rosa, California

Paul A. Offit, M.D.
The Children's Hospital of Philadelphia
Philadelphia, Pennsylvania

Jessie L. Sherrod, M.D.
King Drew Medical Center
Los Angeles, California

Bonnie M. Word, M.D.
Monmouth Junction, New Jersey

EX OFFICIO MEMBERS

Robert F. Breiman, M.D.
Centers for Disease Control and Prevention
Atlanta, Georgia

Geoffrey S. Evans, M.D.
Health Resources and Services Administration
Rockville, Maryland

T. Randolph Graydon
Center for Medicaid and State Operations
Baltimore, Maryland

M. Carolyn Hardegree, M.D.
Food and Drug Administration
Rockville, Maryland

Advisory Committee on Immunization Practices Membership List, October 1998 — Continued

Regina Rabinovich, M.D.
National Institutes of Health
Bethesda, Maryland

Kristin Lee Nichol, M.D., M.P.H.
VA Medical Center
Minneapolis, Minnesota

David H. Trump, M.D., M.P.H.
Office of the Assistant Secretary of Defense (Health Affairs)
Falls Church, Virginia

LIAISON REPRESENTATIVES

American Academy of Family Physicians
Richard Zimmerman, M.D.
Pittsburgh, Pennsylvania

American Academy of Pediatrics
Larry Pickering, M.D.
Norfolk, Virginia
Neal A. Halsey, M.D.
Baltimore, Maryland

American Association of Health Plans
Gregory P. Gilmet, M.D.
South Field, Michigan

American College of Obstetricians and Gynecologists
Stanley A. Gall, M.D.
Louisville, Kentucky

American College of Physicians
Pierce Gardner, M.D.
Stony Brook, New York

American Hospital Association
William Schaffner, M.D.
Nashville, Tennessee

American Medical Association
H. David Wilson, M.D.
Grand Forks, North Dakota

Association of Teachers of Preventive Medicine
W. Paul McKinney, M.D.
Louisville, Kentucky

Biotechnology Industry Organization
Yvonne E. McHugh, Ph.D.
Emeryville, California

Canadian National Advisory Committee on Immunization
Victor Marchessault, M.D.
Cumberland, Ontario

Hospital Infection Control Practices Advisory Committee
Jane D. Siegel, M.D.
Dallas, Texas

Infectious Diseases Society of America
Samuel L. Katz, M.D.
Durham, North Carolina

National Immunization Council and Child Health Program, Mexico
Jose Ignacio Santos, M.D.
Mexico City, Mexico

National Medical Association
Walter Faggett, M.D.
Atlanta, Georgia

National Vaccine Advisory Committee
Georges Peter, M.D.
Providence, Rhode Island

Pharmaceutical Research and Manufacturers of America
Gordon R. Douglas, Jr., M.D.
Whitehouse Station, New Jersey

Members of the Rabies Working Group

Advisory Committee on Immunization Practices (ACIP)

ACIP Members
Charles M. Helms, M.D., Ph.D., Chairman
David W. Fleming, M.D.
Marie R. Griffin, M.D., M.P.H.
M. Carolyn Hardegree, M.D.
John F. Modlin, M.D.

National Association of State and Public Health Veterinarians
Suzanne Jenkins, V.M.D., M.P.H.

Food and Drug Administration
Robin Levis, Ph.D.

Viral and Rickettsial Zoonoses Branch
Division of Viral and Rickettsial Diseases
National Center for Infectious Diseases, CDC
James E. Childs, Sc.D., Acting Branch Chief
Charles E. Rupprecht, V.M.D., Ph.D., Rabies Section Chief
Paul M. Arguin, M.D.
Cathleen Hanlon, V.M.D., Ph.D.
John W. Krebs, M.S.
Jean S. Smith, M.S.
Tracee A. Treadwell, R.N., D.V.M., M.P.H.

The following CDC staff member prepared this report:

Paul M. Arguin, M.D.
Division of Viral and Rickettsial Diseases
National Center for Infectious Diseases

Human Rabies Prevention – United States, 1999
Recommendations of the Advisory Committee on Immunization Practices (ACIP)

Summary

*These revised recommendations of the Advisory Committee on Immunization Practices update the previous recommendations on rabies prevention (MMWR 1991;40[No.RR-3]:1–14) to reflect the current status of rabies and antirabies biologics in the United States. This report includes new information about a human rabies vaccine approved for U.S. use in 1997, recommendations regarding exposure to bats, recommendations regarding an observation period for domestic ferrets, and changes in the local administration of rabies immune globulin.**

INTRODUCTION

Rabies is a viral infection transmitted in the saliva of infected mammals. The virus enters the central nervous system of the host, causing an encephalomyelitis that is almost always fatal. After the marked decrease of rabies cases among domestic animals in the United States in the 1940s and 1950s, indigenously acquired rabies among humans decreased substantially (*1*). In 1950, for example, 4,979 cases of rabies were reported among dogs, and 18 cases were reported among humans. Between 1980 and 1997, 95–247 cases were reported each year among dogs, and on average only two human cases were reported each year in which rabies was attributable to variants of the virus associated with indigenous dogs (*2*). Thus, the likelihood of human exposure to a rabid domestic animal in the United States has decreased greatly. However, during the same period, 12 cases of human rabies were attributed to variants of the rabies virus associated with dogs from outside the United States (*3,4*). Therefore, international travelers to areas where canine rabies is still endemic have an increased risk of exposure to rabies.

Rabies among wildlife — especially raccoons, skunks, and bats — has become more prevalent since the 1950s, accounting for >85% of all reported cases of animal rabies every year since 1976 (*1*). Rabies among wildlife occurs throughout the continental United States; only Hawaii remains consistently rabies-free. Wildlife is the most important potential source of infection for both humans and domestic animals in the United States. Since 1980, a total of 21 (58%) of the 36 human cases of rabies diagnosed in the United States have been associated with bat variants (*2,5,6*). In most other countries — including most of Asia, Africa, and Latin America — dogs remain the major species with rabies and the most common source of rabies among humans. Twelve (33%) of the 36 human rabies deaths reported to the Centers for Disease Control and Prevention (CDC) from 1980 through 1997 appear to have been related to rabid animals outside the United States (*2,6*).

*For assistance with problems or questions about rabies prophylaxis, contact your local or state health department. If local or state health department personnel are unavailable, call the Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases, CDC at (404) 639-1050 during working hours or (404) 639-2888 during nights, weekends, and holidays.

Although rabies among humans is rare in the United States, every year approximately 16,000–39,000 persons receive postexposure prophylaxis (*7*). To appropriately manage potential human exposures to rabies, the risk of infection must be accurately assessed. Administration of rabies postexposure prophylaxis is a medical urgency, not a medical emergency, but decisions must not be delayed. Systemic prophylactic treatments occasionally are complicated by adverse reactions, but these reactions are rarely severe (*8–12*).

Data on the safety, immunogenicity, and efficacy of active and passive rabies immunization have come from both human and animal studies. Although controlled human trials have not been performed, extensive field experience from many areas of the world indicates that postexposure prophylaxis combining wound treatment, passive immunization, and vaccination is uniformly effective when appropriately applied (*13–18*). However, rabies has occasionally developed among humans when key elements of the rabies postexposure prophylaxis regimens were omitted or incorrectly administered (see Treatment Outside the United States).

RABIES BIOLOGICS

Two types of rabies immunizing products are available in the United States (Table 1):

- Rabies vaccines induce an active immune response that includes the production of neutralizing antibodies. This antibody response requires approximately 7–10 days to develop and usually persists for ≥2 years.
- Rabies immune globulin (RIG) provides a rapid, passive immunity that persists for only a short time (half-life of approximately 21 days) (*19*).

In all postexposure prophylaxis regimens, except for persons previously immunized, both products should be used concurrently.

TABLE 1. Rabies biologics — United States, 1999

Human rabies vaccine	Product name	Manufacturer
Human diploid cell vaccine (HDCV) • Intramuscular • Intradermal	 Imovax® Rabies Imovax® Rabies I.D.	Pasteur-Merieux Serum et Vaccins, Connaught Laboratories, Inc. Phone: (800) VACCINE *(822-2463)*
Rabies vaccine adsorbed (RVA) • Intramuscular	Rabies Vaccine Adsorbed (RVA)	BioPort Corporation Phone: (517) 335-8120
Purified chick embryo cell vaccine (PCEC) • Intramuscular	RabAvert™	Chiron Corporation Phone: (800) CHIRON8 *(244-7668)*
Rabies immune globulin (RIG)	Imogam® Rabies-HT	Pasteur-Merieux Serum et Vaccins, Connaught Laboratories, Inc. Phone: (800) VACCINE *(822-2463)*
	BayRab™	Bayer Corporation Pharmaceutical Div. Phone: (800) 288-8370

Vaccines Licensed for Use in the United States

Four formulations of three inactivated rabies vaccines are currently licensed for preexposure and postexposure prophylaxis in the United States (Table 1). When used as indicated, all three types of rabies vaccines are considered equally safe and efficacious. The potency of one dose is ≥2.5 international units (IU) per 1.0 mL of rabies virus antigen, which is the World Health Organization recommended standard (*20*). A full 1.0-mL dose can be used for both preexposure and postexposure prophylaxis. However, only the Imovax® Rabies I.D. vaccine (human diploid cell vaccine [HDCV]) has been evaluated and approved by the Food and Drug Administration (FDA) for the intradermal dose and route for preexposure vaccination (*21–24*). Therefore, rabies vaccine adsorbed (RVA) and purified chick embryo cell vaccine (PCEC) should not be used intradermally. Usually, an immunization series is initiated and completed with one vaccine product. No clinical studies have been conducted that document a change in efficacy or the frequency of adverse reactions when the series is completed with a second vaccine product.

Human Diploid Cell Vaccine (HDCV)

HDCV is prepared from the Pitman-Moore strain of rabies virus grown on MRC-5 human diploid cell culture, concentrated by ultrafiltration, and inactivated with beta-propiolactone (*16*). It is supplied in two forms:

- Intramuscular (IM) administration, a single-dose vial containing lyophilized vaccine that is reconstituted in the vial with the accompanying diluent to a final volume of 1.0 mL just before administration.
- Intradermal (ID) administration, a single-dose syringe containing lyophilized vaccine that is reconstituted in the syringe to a final volume of 0.1 mL just before administration (*25*).

Rabies Vaccine Adsorbed (RVA)

RVA was developed and is currently manufactured and distributed in the state of Michigan by BioPort Corporation. The vaccine is prepared from the Kissling strain of Challenge Virus Standard (CVS) rabies virus adapted to fetal rhesus lung diploid cell culture (*26–31*). The vaccine virus is inactivated with betapropiolactone and concentrated by adsorption to aluminum phosphate. Because RVA is adsorbed to aluminum phosphate, it is liquid rather than lyophilized. It is approved for IM administration only as a 1.0-mL dose.

Purified Chick Embryo Cell Vaccine (PCEC)

PCEC became available in the United States in autumn 1997 (*32*). It is prepared from the fixed rabies virus strain Flury LEP grown in primary cultures of chicken fibroblasts. The virus is inactivated with betapropiolactone and further processed by zonal centrifugation in a sucrose density gradient. It is formulated for IM administration only. PCEC is available in a single-dose vial containing lyophilized vaccine that is reconstituted in the vial with the accompanying diluent to a final volume of 1.0 mL just before administration.

Rabies Immune Globulin Licensed for Use in the United States

The two RIG products, BayRab™ and Imogam® Rabies-HT (Table 1), are an antirabies immunoglobulin (IgG) preparation concentrated by cold ethanol fractionation from plasma of hyperimmunized human donors. Rabies neutralizing antibody, standardized at a concentration of 150 IU per mL, is supplied in 2-mL (300 IU) vials for pediatric use and 10-mL (1,500 IU) vials for adult use; the recommended dose is 20 IU/kg body weight. Both RIG preparations are considered equally efficacious when used as described in this report (see Treatment of Wounds and Immunization).

PRIMARY OR PREEXPOSURE VACCINATION

Preexposure vaccination should be offered to persons in high-risk groups, such as veterinarians, animal handlers, and certain laboratory workers. Preexposure vaccination also should be considered for other persons whose activities bring them into frequent contact with rabies virus or potentially rabid bats, raccoons, skunks, cats, dogs, or other species at risk for having rabies. In addition, international travelers might be candidates for preexposure vaccination if they are likely to come in contact with animals in areas where dog rabies is enzootic and immediate access to appropriate medical care, including biologics, might be limited. Routine preexposure prophylaxis for other situations might not be indicated (*33,34*).

Preexposure prophylaxis is administered for several reasons. First, although preexposure vaccination does not eliminate the need for additional therapy after a rabies exposure, it simplifies therapy by eliminating the need for RIG and decreasing the number of doses of vaccine needed — a point of particular importance for persons at high risk for being exposed to rabies in areas where immunizing products might not be available or where they might be at high risk for adverse reactions. Second, preexposure prophylaxis might protect persons whose postexposure therapy is delayed. Finally, it might provide protection to persons at risk for inapparent exposures to rabies.

Intramuscular Primary Vaccination

Three 1.0-mL injections of HDCV, RVA, or PCEC should be administered intramuscularly (deltoid area) — one injection per day on days 0, 7, and 21 or 28 (Table 2). In a study in the United States, >1,000 persons received HDCV according to this regimen. Antibody was found in serum samples of all subjects when tested by the rapid fluorescent focus inhibition test (RFFIT). Studies with other products have produced comparable results (*21,35–39*).

Intradermal Primary Vaccination

A regimen of three 0.1-mL ID doses of HDCV, one each on days 0, 7, and 21 or 28, is also used for preexposure vaccination (Table 2) as an alternative to the 1.0-mL IM regimen for rabies preexposure prophylaxis with HDCV (*8,21,22,24,35–37,40*). A single dose of lyophilized HDCV (Imovax® Rabies I.D.) is available prepackaged for reconstitution in the syringe just before administration. The syringe is designed to deliver 0.1 mL of HDCV reliably and has been approved by the FDA since 1986 (*25*).

TABLE 2. Rabies preexposure prophylaxis schedule — United States, 1999

Type of vaccination	Route	Regimen
Primary	Intramuscular	HDCV, PCEC or RVA; 1.0 mL (deltoid area), one each on days 0,* 7, and 21 or 28
	Intradermal	HDCV; 0.1 mL, one each on days 0,* 7, and 21 or 28
Booster	Intramuscular	HDCV, PCEC, or RVA; 1.0 mL (deltoid area), day 0* only
	Intradermal	HDCV; 0.1 mL, day 0* only

HDCV=human diploid cell vaccine; PCEC=purified chick embryo cell vaccine; RVA=rabies vaccine adsorbed.
* Day 0 is the day the first dose of vaccine is administered.

The 0.1-mL ID doses, administered in the area over the deltoid (lateral aspect of the upper arm) on days 0, 7, and 21 or 28, are used for primary preexposure vaccination. One 0.1-mL ID dose is used for routine preexposure booster vaccination (Table 2). The 1.0-mL vial is not approved for multidose ID use. RVA and PCEC are not approved for and should not be administered intradermally (*26*).

When chloroquine phosphate was used routinely for malaria prophylaxis, investigators discovered that the drug decreased the antibody response to concomitantly administered HDCV (*41*). Although interference with the immune response to rabies vaccine by other antimalarials structurally related to chloroquine (e.g., mefloquine) has not been evaluated, precautions for persons receiving these drugs should be followed. Accordingly, HDCV should not be administered intradermally to a person traveling to malaria-endemic countries while the person is receiving one of these antimalarials (*42*). The IM administration of three doses of 1.0 mL of vaccine for preexposure prophylaxis provides a sufficient margin of safety in this situation (*42*). For persons who will be receiving both rabies preexposure prophylaxis and antimalarial chemoprophylaxis in preparation for travel to a rabies-enzootic area, the ID regimen should be initiated at least 1 month before travel to allow for completion of the full three-dose vaccine series before antimalarial prophylaxis begins. If this schedule is not possible, the IM regimen should be used.

Preexposure Booster Doses of Vaccine

Persons who work with rabies virus in research laboratories or vaccine production facilities (continuous risk category [Table 3] [*43*]) are at the highest risk for inapparent exposures. Such persons should have a serum sample tested for rabies antibody every 6 months. Booster doses (IM or ID [Table 2]) of vaccine should be administered to maintain a serum titer corresponding to at least complete neutralization at a 1:5 serum dilution by the RFFIT. The frequent-risk category includes other laboratory workers (e.g., those performing rabies diagnostic testing), spelunkers, veterinarians and staff, and animal-control and wildlife officers in areas where animal rabies is enzootic. Persons in this group should have a serum sample tested for rabies antibody every 2 years; if the titer is less than complete neutralization at a 1:5 serum dilution by the RFFIT, the person also should receive a single booster dose of vaccine. Veterinarians, veterinary students, and animal-control and wildlife officers working in areas

TABLE 3. Rabies preexposure prophylaxis guide — United States, 1999

Risk category	Nature of risk	Typical populations	Preexposure recommendations
Continuous	Virus present continuously, often in high concentrations. Specific exposures likely to go unrecognized. Bite, nonbite, or aerosol exposure.	Rabies research laboratory workers;* rabies biologics production workers.	Primary course. Serologic testing every 6 months; booster vaccination if antibody titer is below acceptable level.†
Frequent	Exposure usually episodic, with source recognized, but exposure also might be unrecognized. Bite, nonbite, or aerosol exposure.	Rabies diagnostic lab workers,* spelunkers, veterinarians and staff, and animal-control and wildlife workers in rabies-enzootic areas.	Primary course. Serologic testing every 2 years; booster vaccination if antibody titer is below acceptable level.†
Infrequent (greater than population at large)	Exposure nearly always episodic with source recognized. Bite or nonbite exposure.	Veterinarians and animal-control and wildlife workers in areas with low rabies rates. Veterinary students. Travelers visiting areas where rabies is enzootic and immediate access to appropriate medical care including biologics is limited.	Primary course. No serologic testing or booster vaccination.
Rare (population at large)	Exposure always episodic with source recognized. Bite or nonbite exposure.	U.S. population at large, including persons in rabies-epizootic areas.	No vaccination necessary.

* Judgment of relative risk and extra monitoring of vaccination status of laboratory workers is the responsibility of the laboratory supervisor (*43*).
† Minimum acceptable antibody level is complete virus neutralization at a 1:5 serum dilution by the rapid fluorescent focus inhibition test. A booster dose should be administered if the titer falls below this level.

with low rabies rates (infrequent exposure group) and at-risk international travelers do not require routine preexposure booster doses of vaccine after completion of primary preexposure vaccination.

Postexposure Therapy for Previously Vaccinated Persons

If exposed to rabies, previously vaccinated persons should receive two IM doses (1.0 mL each) of vaccine, one immediately and one 3 days later. Previously vaccinated persons are those who have received one of the recommended preexposure or postexposure regimens of HDCV, RVA, or PCEC, or those who received another vaccine and had a documented rabies antibody titer. RIG is unnecessary and should not be administered to these persons because an anamnestic response will follow the administration of a booster regardless of the prebooster antibody titer (*44*).

Preexposure Vaccination and Serologic Testing

Because the antibody response has been satisfactory after these recommended preexposure prophylaxis vaccine regimens, routine serologic testing to confirm seroconversion is not necessary except for persons suspected of being immunosuppressed. Patients who are immunosuppressed by disease or medications should postpone preexposure vaccinations and consider avoiding activities for which rabies preexposure prophylaxis is indicated. When that is not possible, immunosuppressed persons who are at risk for exposure to rabies should be vaccinated and their antibody titers checked. In these cases, failures to seroconvert after the third dose should be managed in consultation with appropriate public health officials.

POSTEXPOSURE PROPHYLAXIS

Rationale for Treatment

Administration of rabies postexposure prophylaxis is a medical urgency, not a medical emergency. Physicians should evaluate each possible exposure to rabies and, if necessary, consult with local or state public health officials regarding the need for rabies prophylaxis (Table 4). In the United States, the following factors should be considered before specific antirabies postexposure prophylaxis is initiated.

TABLE 4. Rabies postexposure prophylaxis guide — United States, 1999

Animal type	Evaluation and disposition of animal	Postexposure prophylaxis recommendations
Dogs, cats, and ferrets	Healthy and available for 10 days observation	Persons should not begin prophylaxis unless animal develops clinical signs of rabies.*
	Rabid or suspected rabid	Immediately vaccinate.
	Unknown (e.g., escaped)	Consult public health officials.
Skunks, raccoons, foxes and most other carnivores; bats	Regarded as rabid unless animal proven negative by laboratory tests†	Consider immediate vaccination.
Livestock, small rodents, lagomorphs (rabbits and hares), large rodents (woodchucks and beavers), and other mammals	Consider individually.	Consult public health officials. Bites of squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, mice, other small rodents, rabbits, and hares almost never require antirabies postexposure prophylaxis.

*During the 10-day observation period, begin postexposure prophylaxis at the first sign of rabies in a dog, cat, or ferret that has bitten someone. If the animal exhibits clinical signs of rabies, it should be euthanized immediately and tested.

†The animal should be euthanized and tested as soon as possible. Holding for observation is not recommended. Discontinue vaccine if immunofluorescence test results of the animal are negative.

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

MMWR™
MORBIDITY AND MORTALITY WEEKLY REPORT

January 8, 1999 / Vol. 48 / No. RR-1

Recommendations and Reports

Continuing Education Activity Sponsored by CDC

Human Rabies Prevention — United States, 1999
Recommendations of the Advisory Committee on Immunization Practices (ACIP)

OBJECTIVE

This *MMWR* provides recommendations for preventing rabies among humans. These recommendations were developed by CDC staff members and the Rabies Working Group of the ACIP. This report is intended to guide clinical practice and policy development related to appropriate management of persons at risk for rabies. Upon completion of this educational activity, the reader should be able to identify groups for whom rabies preexposure prophylaxis is indicated; identify groups for whom rabies serologic testing and booster dosing are indicated; identify some of the common rabies reservoirs in the United States; describe the essential elements of rabies postexposure prophylaxis; and describe appropriate management of persons exposed to bats.

ACCREDITATION

Continuing Medical Education (CME): This activity has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education (ACCME) by CDC. CDC is accredited by the ACCME to provide continuing medical education for physicians. CDC designates this educational activity for a maximum of 1 hour in category 1 credit toward the AMA Physician's Recognition Award.

Continuing Education Units (CEU): CDC awards 0.1 hours of CEUs. This activity has been structured following the International Association for Continuing Education and Training (IACET) Criteria and Guidelines and therefore is awarding CEUs. The CEU is a nationally recognized unit designed to provide a record of an individual's continuing education accomplishments.

Continuing Nursing Education (CNE) Credit: This activity for 1.2 contact hours is provided by CDC, which is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's (ANCC) Commission on Accreditation.

EXPIRATION — January 8, 2000

The response form must be completed and returned electronically, by fax, or by mail, **postmarked no later than one year from the publication date of this report**, for eligibility to receive continuing education credit.

INSTRUCTIONS

1. Read this *MMWR (Vol. 48, RR-1*), which contains the correct answers to the questions beginning on the next page.
2. Complete all registration information on the response form, including your name, mailing address, phone number, and e-mail address, if available.
3. Indicate whether you are registering for Continuing Medical Education (CME), Continuing Education Unit (CEU), *or* Continuing Nursing Education (CNE) credit.
4. Select your answers to the questions, and mark the corresponding letters on the response form. To receive continuing education credit, you must answer *all* of the questions. Questions with more than one answer will instruct you to "indicate all that are true."
5. Sign and date the response form.
6. Return the response form, or a photocopy of the form, no later than **January 8, 2000**, to CDC by one of the following methods:

   Fax: 404-639-4198
   Internet: <http://www.cdc.gov/epo/mmwr/mmwr.html>

   Mail: MMWR CE Credit
   Office of Scientific and Health Communications
   Epidemiology Program Office — MS C08
   Centers for Disease Control and Prevention
   1600 Clifton Road, N.E.
   Atlanta, GA 30333

If you answer all of the questions, you will receive an award letter for 1 hour of CME credit, 0.1 hour of CEU credit, or 1.2 hours of CNE credit within 90 days. No fees are charged for participating in this continuing education activity.

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES

1. In which of the following situations would it be appropriate to administer rabies postexposure prophylaxis? ***(Indicate all that are true.)***

A. A family discovers a colony of bats in the garage of their home.

B. The family cat brings a dead bat into the yard and the 5-year-old son handles it.

C. A dead bat (which is tested and found to be positive for rabies) is found in the crib of a 6-month-old baby.

D. A troop of Boy Scouts witnesses the emergence of a colony of bats from a cave.

2. Which of the following are not components of postexposure prophylaxis in the United States? ***(Indicate all that are false.)***

A. Thorough cleaning of the wound with at least soap and water.

B. Administration of as much rabies immune globulin as possible at the exposure site.

C. Intradermal administration of rabies vaccine.

D. Intramuscular administration of rabies vaccine.

3. Which of the following statements are true about rabies preexposure prophylaxis? ***(Indicate all that are true.)***

A. It is indicated for international travelers only if they will be in a country where rabies is enzootic for greater than 30 days.

B. It consists of 3 doses of rabies vaccine administered intramuscularly or intradermally.

C. In the event of an exposure, persons who have received preexposure prophylaxis still require 2 booster doses of rabies vaccine, but no rabies immune globulin.

D. Veterinarians in areas where rabies is enzootic should have titers checked every 2 years.

4. Which of the following would be appropriate responses to concerns about nosocomial transmission of rabies from a hospitalized patient suspected of having rabies? ***(Indicate all that are true.)***

A. Contact your local or state health department for assistance.

B. Advise that the patient be placed in a negative pressure isolation room.

C. Advise immediate vaccination of all hospital personnel involved in the care of the patient.

D. Encourage adherence to standard precautions.

5. A person reports an unprovoked bite from a stray dog. The dog was captured by animal control and appears healthy. What are the appropriate actions? ***(Indicate all that are true.)***

A. Confine and observe the dog for 10 days for signs suggestive of rabies.

B. Immediately begin postexposure prophylaxis.

C. Consult your local or state health department.

D. Because canine rabies has decreased in the United States, dog bites are no longer indications for postexposure prophylaxis and no further action is needed.

6. Which of the following animals are frequently reported rabid in the United States? ***(Indicate all that are true.)***

A. Squirrels

B. Raccoons

C. Rabbits

D. Skunks

E. Bats

7. Which of the following statements about the timing of postexposure prophylaxis are true? ***(Indicate all that are true.)***

A. For postexposure prophylaxis to be effective, it must always be administered on the same day the exposure occurred.

B. Postexposure prophylaxis should be administered regardless of any delay after a true exposure.

C. If rabies immune globulin was not administered when vaccination was begun, it can be administered through the seventh day after the administration of the first dose of vaccine.

D. Day 0 refers to the day the first dose of vaccine was administered.

8. Which of the following statements are true? ***(Indicate all that are true.)***

A. Human rabies is a fatal disease 50% of the time.

B. In the last 2 decades, most human rabies cases in the United States have been associated with bat variants of the rabies virus.

C. U.S. citizens traveling abroad can be at risk of exposure to canine rabies.

D. Although human rabies cases in the United States are rare, exposure to rabid or potentially rabid animals remains a relatively common event.

9. Indicate your work setting.

A. State/local health department

B. Other public health agency

C. Public hospital

D. Managed care organization/private hospital or practice

E. Academic hospital

F. Other

10. Which best describes your professional activities?

A. Patient care — emergency/urgent care department

B. Patient care — inpatient

C. Patient care — primary care clinic

D. Laboratory/pharmacy

E. Administration/public health

F. Veterinary medicine/animal control

11. Have you ever been involved in the administration of postexposure prophylaxis? ***(In this three-part question, indicate all that apply.)***

A. Yes

B. No

Did you refer to the previous Rabies Prevention Guidelines of the ACIP?

C. Yes

D. No

Did you contact public health officials for advice?

E. Yes

F. No

12. Are rabies vaccine and rabies immune globulin available in your work setting or readily available if needed?

A. Yes, available in work setting

B. Yes, available if needed

C. No or unsure

13. I plan to use these guidelines as the basis for: ***(Indicate all that apply.)***

A. Health education materials

B. Insurance reimbursement policies

C. Local practice guidelines

D. Public policy

E. Other

14. How much time was required to complete this continuing education activity (both reading the document and completing the test)?

A. ≤1 hour

B. >1 hour but <1½ hours

C. ≥1½ hours

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
15. Overall, this report met the stated objectives.	A	B	C	D	E
16. The tables and figures are useful.	A	B	C	D	E
17. These recommendations will affect my practice.	A	B	C	D	E

Answer guide for questions 1–8.
1. B, C; 2. C; 3. B, C, D; 4. A, D ; 5. A, C; 6. B, D, E; 7. B, C, D; 8. B, C, D

MMWR RESPONSE FORM for CME/CEU/CNE Credit
MMWR Vol. 48/No. RR-1. January 8, 1999

Human Rabies Prevention — United States, 1999
Recommendations of the Advisory Committee on Immunization Practices (ACIP)

Fill in the appropriate block(s) to indicate your answer(s). T**o receive continuing education credit, you must answer all of the questions.**

Detach or photocopy.

1.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
2.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
3.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
4.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
5.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
6.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
7.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
8.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
9.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
10.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
11.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
12.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
13.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
14.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
15.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
16.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F
17.	[ ] A	[ ] B	[ ] C	[ ] D	[ ] E	[ ] F

Please Print:

Name: _____
(Signature)

Address: _____

_____

Telephone No.: _____ E-mail: _____

Fax No.: _____

Check one box below:

- ☐ 1 hour of CME credit
- ☐ 0.1 hour of CEU credit
- ☐ 1.2 hours of CNE credit

I completed this exam on

_____
(Date)

DEPARTMENT OF
HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
and Prevention (CDC)
Atlanta, Georgia 30333

Official Business
Penalty for Private Use, $300

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 99110 ATLANTA, GA 30333

Postage Will Be Paid by Department of Health and Human Services

MMWR CE Credit
Office of Scientific and Health Communications
Epidemiology Program Office — Mailstop C08
Centers for Disease Control and Prevention
1600 Clifton Road, N.E.
Atlanta, Georgia 30333

Types of Exposure

Rabies is transmitted only when the virus is introduced into bite wounds or open cuts in skin or onto mucous membranes. If no exposure has occurred (i.e., no bite or nonbite exposure), postexposure prophylaxis is not necessary. The likelihood of rabies infection varies with the nature and extent of exposure. Two categories of exposure — bite and nonbite — should be considered.

Bite

Any penetration of the skin by teeth constitutes a bite exposure. All bites, regardless of location, represent a potential risk of rabies transmission. Bites by some animals, such as bats, can inflict minor injury and thus be undetected (*45*).

Nonbite

Nonbite exposures from terrestrial animals rarely cause rabies. However, occasional reports of transmission by nonbite exposure suggest that such exposures constitute sufficient reason to consider postexposure prophylaxis (*46*). The nonbite exposures of highest risk appear to be among persons exposed to large amounts of aerosolized rabies virus and surgical recipients of corneas transplanted from patients who died of rabies. Two cases of rabies have been attributed to probable aerosol exposures in laboratories, and two cases of rabies have been attributed to possible airborne exposures in caves containing millions of free-tailed bats (*Tadarida brasiliensis*) in the Southwest (*47–51*).

The contamination of open wounds, abrasions, mucous membranes, or theoretically, scratches, with saliva or other potentially infectious material (such as neural tissue) from a rabid animal also constitutes a nonbite exposure. Other contact by itself, such as petting a rabid animal and contact with blood, urine, or feces (e.g., guano) of a rabid animal, does not constitute an exposure and is not an indication for prophylaxis. Because the rabies virus is inactivated by desiccation and ultraviolet irradiation, in general, if the material containing the virus is dry, the virus can be considered noninfectious.

Human-to-Human Transmission

Human-to-human transmission has occurred among eight recipients of transplanted corneas. Investigations revealed each of the donors had died of an illness compatible with or proven to be rabies (*52–58*). The eight cases occurred in five countries: Thailand (two cases), India (two cases), Iran (two cases), the United States (one case), and France (one case). Stringent guidelines for acceptance of donor corneas have been implemented to reduce this risk.

Apart from corneal transplants, bite and nonbite exposures inflicted by infected humans could theoretically transmit rabies, but no laboratory-diagnosed cases occurring under such situations have been documented (*59*). Two nonlaboratory-confirmed cases of human-to-human rabies transmission in Ethiopia have been described (*60*). The reported route of exposure in both cases was direct salivary contact from another human (a bite and a kiss). Routine delivery of health care to a patient with rabies is not an indication for postexposure prophylaxis unless exposure of mucous membranes or nonintact skin to potentially infectious body fluids has occurred. Adherence to

standard precautions as outlined by the Hospital Infection Control Practices Advisory Committee will minimize the risk of exposure (*61*).

Animal Rabies Epidemiology and Evaluation of Involved Species

Bats

Rabid bats have been documented in the 49 continental states, and bats are increasingly implicated as important wildlife reservoirs for variants of rabies virus transmitted to humans (*1*). Recent epidemiologic data suggest that transmission of rabies virus can occur from minor, seemingly unimportant, or unrecognized bites from bats (*5,6,62*). The limited injury inflicted by a bat bite (in contrast to lesions caused by terrestrial carnivores) and an often inaccurate recall of the exact exposure history might limit the ability of health-care providers to determine the risk of rabies resulting from an encounter with a bat (*45*). Human and domestic animal contact with bats should be minimized, and bats should never be handled by untrained and unvaccinated persons or be kept as pets (*6,63*).

In all instances of potential human exposures involving bats, the bat in question should be safely collected, if possible, and submitted for rabies diagnosis. Rabies postexposure prophylaxis is recommended for all persons with bite, scratch, or mucous membrane exposure to a bat, unless the bat is available for testing and is negative for evidence of rabies. Postexposure prophylaxis might be appropriate even if a bite, scratch, or mucous membrane exposure is not apparent when there is reasonable probability that such exposure might have occurred.

On the basis of the available but sometimes conflicting information from the 21 bat-associated cases of human rabies reported since 1980, in 1–2 cases, a bite was reported; in 10–12 cases, apparent contact occurred but no bite was detected; and in 7–10 cases, no exposure to bats was reported, but an undetected or unreported bat bite remains the most plausible hypothesis. Clustering of bat-associated human cases within the same household has never been reported.

Consequently, postexposure prophylaxis should be considered when direct contact between a human and a bat has occurred, unless the exposed person can be certain a bite, scratch, or mucous membrane exposure did not occur. In instances in which a bat is found indoors and there is no history of bat-human contact, the likely effectiveness of postexposure prophylaxis must be balanced against the low risk such exposures appear to present. In this setting, postexposure prophylaxis can be considered for persons who were in the same room as the bat and who might be unaware that a bite or direct contact had occurred (e.g., a sleeping person awakens to find a bat in the room or an adult witnesses a bat in the room with a previously unattended child, mentally disabled person, or intoxicated person) and rabies cannot be ruled out by testing the bat. Postexposure prophylaxis would not be warranted for other household members.

Wild Terrestrial Carnivores

Raccoons, skunks, foxes, and coyotes are the terrestrial animals most often infected with rabies. All bites by such wildlife must be considered possible exposures to the rabies virus. Postexposure prophylaxis should be initiated as soon as possible after patients are exposed to wildlife unless the animal has already been tested and shown not to be rabid. If postexposure prophylaxis has been initiated and subsequent

immunofluorescence testing shows that the exposing animal was not rabid, postexposure prophylaxis can be discontinued.

Signs of rabies among wildlife cannot be interpreted reliably; therefore, any such animal that exposes a person should be euthanized at once (without unnecessary damage to the head) and the brain should be submitted for rabies testing (*64*). If the results of testing are negative by immunofluorescence, the saliva can be assumed to contain no virus, and the person bitten does not require postexposure prophylaxis.

Other Wild Animals

Small rodents (e.g., squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, and mice) and lagomorphs (including rabbits and hares) are almost never found to be infected with rabies and have not been known to transmit rabies to humans. From 1990 through 1996, in areas of the country where raccoon rabies was enzootic, woodchucks accounted for 93% of the 371 cases of rabies among rodents reported to CDC (*1,65,66*). In all cases involving rodents, the state or local health department should be consulted before a decision is made to initiate antirabies postexposure prophylaxis (*67*).

The offspring of wild animals crossbred to domestic dogs and cats (wild animal hybrids) are considered wild animals by the National Association of State and Public Health Veterinarians (NASPHV) and the Council of State and Territorial Epidemiologists (CSTE). Because the period of rabies virus shedding in these animals is unknown, these animals should be euthanized and tested rather than confined and observed when they bite humans. Wild animals and wild animal hybrids should not be kept as pets (*63*). Animals maintained in United States Department of Agriculture-licensed research facilities or accredited zoological parks should be evaluated on a case-by-case basis.

Domestic Dogs, Cats, and Ferrets

The likelihood of rabies in a domestic animal varies by region; hence, the need for postexposure prophylaxis also varies. In the continental United States, rabies among dogs is reported most commonly along the United States-Mexico border and sporadically in areas of the United States with enzootic wildlife rabies. During most of the 1990s, more cats than dogs were reported rabid in the United States. The majority of these cases were associated with the epizootic of rabies among raccoons in the eastern United States. The large number of rabies-infected cats might be attributed to fewer cat vaccination laws, fewer leash laws, and the roaming habits of cats. In many developing countries, dogs are the major vector of rabies; exposures to dogs in such countries represent an increased risk of rabies transmission.

On the basis of new information regarding rabies pathogenesis and viral shedding patterns in ferrets, ferrets are now considered in this category with dogs and cats rather than as wild terrestrial carnivores (*68*). A healthy domestic dog, cat, or ferret that bites a person may be confined and observed for 10 days. Any illness in the animal during confinement or before release should be evaluated by a veterinarian and reported immediately to the local public health department. If signs suggestive of rabies develop, the animal should be euthanized and its head removed and shipped, under refrigeration, for examination by a qualified laboratory. If the biting animal is

stray or unwanted, it should either be observed for 10 days or be euthanized immediately and submitted for rabies examination (*63*).

Circumstances of Biting Incident and Vaccination Status of Exposing Animal

An unprovoked attack by an animal is more likely than a provoked attack to indicate that the animal is rabid. Bites inflicted on a person attempting to feed or handle an apparently healthy animal should generally be regarded as provoked. A currently vaccinated dog, cat, or ferret is unlikely to become infected with rabies (*68–71*).

Treatment of Wounds and Immunization

The essential components of rabies postexposure prophylaxis are wound treatment and, for previously unvaccinated persons, the administration of both RIG and vaccine (Table 5 [*72*]). Persons who have been bitten by animals suspected or proven to be rabid should begin postexposure prophylaxis immediately. Incubation periods of >1 year have been reported in humans (*73*). Thus, when a documented or likely exposure has occurred, postexposure prophylaxis is indicated regardless of the length of the delay, provided the clinical signs of rabies are not present.

In 1977, the World Health Organization recommended a regimen of RIG and six doses of HDCV over a 90-day period. This recommendation was based on studies in Germany and Iran (*14,18*). When used this way, the vaccine was found to be safe and effective in protecting persons bitten by animals proven to be rabid and induced an excellent antibody response in all recipients (*14*). Studies conducted in the United States by CDC have documented that a regimen of one dose of RIG and five doses of HDCV over a 28-day period was safe and induced an excellent antibody response in all recipients (*13*). Clinical trials with RVA and PCEC have demonstrated immunogenicity equivalent to that of HDCV (*26,74*).

Treatment of Wounds

Immediate and thorough washing of all bite wounds and scratches with soap and water and a virucidal agent such as a povidone-iodine solution irrigation are important measures for preventing rabies (*72*). In studies of animals, thorough wound cleansing alone without other postexposure prophylaxis has been shown to reduce markedly the likelihood of rabies (*75,76*). Tetanus prophylaxis and measures to control bacterial infection also should be administered as indicated (*77*). The decision to suture large wounds should take into account cosmetic factors and the potential for bacterial infections.

Immunization

Postexposure antirabies vaccination should always include administration of both passive antibody and vaccine, with the exception of persons who have previously received complete vaccination regimens (preexposure or postexposure) with a cell culture vaccine or persons who have been vaccinated with other types of vaccines and have had documented rabies antibody titers. These persons should receive only vaccine (see Postexposure Therapy for Previously Vaccinated Persons). The combination of RIG and vaccine is recommended for both bite and nonbite exposures (see

TABLE 5. Rabies postexposure prophylaxis schedule — United States, 1999

Vaccination status	Treatment	Regimen*
Not previously vaccinated	Wound cleansing	All postexposure treatment should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as a povidone-iodine solution should be used to irrigate the wounds (*72*).
	RIG	Administer 20 IU/kg body weight. If anatomically feasible, **the full dose** should be infiltrated around the wounds(s) and any remaining volume should be administered IM at an anatomical site distant from vaccine administration. Also, RIG should not be administered in the same syringe as vaccine. Because RIG might partially suppress active production of antibody, no more than the recommended dose should be given.
	Vaccine	HDCV, RVA, or PCEC 1.0 mL, IM (deltoid area†), one each on days 0§, 3, 7, 14, and 28.
Previously vaccinated¶	Wound cleansing	All postexposure treatment should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as a povidone-iodine solution should be used to irrigate the wounds (*72*).
	RIG	RIG should **not** be administered.
	Vaccine	HDCV, RVA, or PCEC 1.0 mL, IM (deltoid area†), one each on days 0§ and 3.

HDCV=human diploid cell vaccine; PCEC=purified chick embryo cell vaccine; RIG=rabies immune globulin; RVA=rabies vaccine adsorbed; IM, intramuscular.
*These regimens are applicable for all age groups, including children.
†The deltoid area is the only acceptable site of vaccination for adults and older children. For younger children, the outer aspect of the thigh may be used. Vaccine should never be administered in the gluteal area.
§Day 0 is the day the first dose of vaccine is administered.
¶Any person with a history of preexposure vaccination with HDCV, RVA or PCEC; prior postexposure prophylaxis with HDCV, RVA, or PCEC; or previous vaccination with any other type of rabies vaccine and a documented history of antibody response to the prior vaccination.

Rationale for Treatment), regardless of the interval between exposure and initiation of treatment.

Rabies Immune Globulin Use. RIG is administered only once (i.e., at the beginning of antirabies prophylaxis) to previously unvaccinated persons to provide immediate antibodies until the patient responds to HDCV, RVA, or PCEC by actively producing antibodies. If RIG was not administered when vaccination was begun, it can be administered through the seventh day after the administration of the first dose of vaccine (*78*). Beyond the seventh day, RIG is not indicated since an antibody response to cell culture vaccine is presumed to have occurred. Because RIG can partially suppress active production of antibody, no more than the recommended dose should be administered (*79*). The recommended dose of human RIG is 20 IU/kg body weight. This formula is applicable to all age groups, including children. If anatomically feasible, the

full dose of RIG should be thoroughly infiltrated in the area around and into the wounds. Any remaining volume should be injected intramuscularly at a site distant from vaccine administration. This change in the recommendations for RIG administration is based on reports of rare failures of postexposure prophylaxis when smaller amounts of RIG were infiltrated at the exposure sites (*80*). RIG should never be administered in the same syringe or in the same anatomical site as vaccine.

Vaccine Use. Three rabies vaccines are currently available in the United States (Table 1); any one of the three can be administered in conjunction with RIG at the beginning of postexposure therapy. A regimen of five 1-mL doses of HDCV, RVA, or PCEC should be administered intramuscularly. The first dose of the five-dose course should be administered as soon as possible after exposure. Additional doses should be administered on days 3, 7, 14, and 28 after the first vaccination. For adults, the vaccination should always be administered IM in the deltoid area. For children, the anterolateral aspect of the thigh is also acceptable. The gluteal area should never be used for HDCV, RVA, or PCEC injections because administration of HDCV in this area results in lower neutralizing antibody titers (*81*).

Treatment Outside the United States

U.S. citizens who are exposed to rabies while traveling outside the United States in countries where rabies is enzootic might sometimes receive postexposure therapy with regimens or biologics that are not used in the United States (Table 6). This information is provided to familiarize physicians with some of the regimens used more widely abroad. The regimens described in the references in this report have not been submitted for approval by the FDA for use in the United States (*82–93*). If postexposure prophylaxis is begun outside the United States using one of these regimens or biologics of nerve tissue origin, it might be necessary to provide additional therapy when the patient reaches the United States. State or local health departments should be contacted for specific advice in such cases. If titers are obtained, specimens collected 2–4 weeks after preexposure or postexposure prophylaxis should completely neutralize challenge virus at a 1:5 serum dilution by the RFFIT.

Purified equine rabies immune globulin (ERIG) has been used effectively in developing countries where RIG might not have been available. The incidence of adverse reactions has been low (0.8%–6.0%), and most of those that occurred were minor (*94–96*). In addition, unpurified antirabies serum of equine origin might still be used in some countries where neither RIG nor ERIG are available. The use of this antirabies serum is associated with higher rates of serious adverse reactions, including anaphylaxis *(97*).

TABLE 6. Cell culture rabies vaccines widely available outside the United States

Purified chick embryo cell vaccine (PCEC)	Rabipur®
Purified vero cell rabies vaccine (PVRV)	Verorab™ Imovax – Rabies vero™ TRC Verorab™
Human diploid cell vaccine (HDCV)	Rabivac™
Purified duck embryo vaccine (PDEV)	Lyssavac N™

Although no postexposure vaccine failures have occurred in the United States since cell culture vaccines have been routinely used, failures have occurred abroad when some deviation was made from the recommended postexposure treatment protocol or when less than the currently recommended amount of antirabies sera was administered (*80,98–100*). Specifically, patients who contracted rabies after postexposure prophylaxis did not have their wounds cleansed with soap and water, did not receive their rabies vaccine injections in the deltoid area (i.e., vaccine was administered in the gluteal area), or did not receive RIG around the wound site.

VACCINATION AND SEROLOGIC TESTING

Serologic Response Shortly After Vaccination

All persons tested during several CDC studies 2–4 weeks after completion of preexposure and postexposure rabies prophylaxis in accordance with ACIP guidelines have demonstrated an antibody response to rabies (*13,38,101,102*). Therefore, serum samples from patients completing preexposure or postexposure prophylaxis do not need to be tested to document seroconversion unless the person is immunosuppressed (see Precautions and Contraindications). If titers are obtained, specimens collected 2–4 weeks after preexposure or postexposure prophylaxis should completely neutralize challenge virus at a 1:5 serum dilution by the RFFIT. In animal studies, neutralizing antibody titers have been shown to be imperfect markers of protection. Antibody titers will vary with time since the last vaccination. Differences among laboratories that test blood samples also can influence the results.

Cell culture vaccines have been used effectively with RIG or ERIG worldwide to treat persons bitten by various rabid animals (*13,14*). Worldwide, the World Health Organization estimates that 10–12 million persons are started on postexposure therapy annually (*74*). An estimated 16,000–39,000 persons in the United States receive a full postexposure course with HDCV each year (*7*). When postexposure prophylaxis has been properly administered, no treatment failures have occurred in the United States.

Serologic Response and Preexposure Booster Doses of Vaccine

Although antibody levels do not define a person's immune status, they are a marker of continuing immune response (*103*). To ensure the continuity of an immune response, titers should be checked periodically, with booster doses administered as needed. Two years after primary preexposure vaccination, a 1:5 serum dilution will neutralize challenge virus completely (by the RFFIT) among 93%–98% of persons who received the three-dose preexposure series intramuscularly and 83%–95% of persons who received the three-dose series intradermally (*104*). If the titer falls below the minimum acceptable antibody level, a preexposure booster dose of vaccine is recommended for a person at continuous or frequent risk for exposure to rabies (Table 3). The following guidelines are recommended for determining when serum testing should be performed after primary preexposure vaccination:

- A person in the continuous-risk category (Table 3) should have a serum sample tested for rabies antibody every 6 months (*43*).
- A person in the frequent-risk category (Table 3) should have a serum sample tested for rabies antibody every 2 years (*105*).

State or local health departments can provide the names and addresses of laboratories performing rabies serologic testing.

ADVERSE REACTIONS

HDCV, RVA, and PCEC

Reactions after vaccination with HDCV, RVA, and PCEC are less serious and less common than with previously available vaccines (*74,106,107*). In previous studies with HDCV, local reactions (e.g., pain, erythema, and swelling or itching at the injection site) have been reported among 30%–74% of recipients (*108*). Systemic reactions (e.g., headache, nausea, abdominal pain, muscle aches, and dizziness) have been reported among 5%–40% of recipients. Three cases of neurologic illness resembling Guillain-Barré syndrome that resolved without sequelae in 12 weeks have been reported (*8,109,110*). In addition, other central and peripheral nervous system disorders have been temporally associated with HDCV vaccine, but a causal relationship has not been established in these rare reports (*111*).

An immune complex-like reaction occurred among approximately 6% of persons who received booster doses of HDCV 2–21 days after administration of the booster dose (*9,10*). The patients developed generalized urticaria, sometimes accompanied by arthralgia, arthritis, angioedema, nausea, vomiting, fever, and malaise. In no cases have these reactions been life-threatening. This reaction occurred less frequently among persons receiving primary vaccination. The reactions have been associated with the presence of betapropiolactone-altered human albumin in the HDCV and the development of immunoglobulin E (IgE) antibodies to this allergen (*112–114*).

Rabies Immune Globulin (Human)

Local pain and low-grade fever might follow receipt of RIG. Although not reported specifically for RIG, angioneurotic edema, nephrotic syndrome, and anaphylaxis have been reported after injection of immune globulin (IG), a product similar in biochemical composition but without antirabies activity. These reactions occur so rarely that a causal relationship between IG and these reactions has not been established.

Both formulations of RIG, BayRab™ and Imogam®Rabies-HT, undergo multiple viral clearance procedures during preparation. There is no evidence that any viruses have ever been transmitted by commercially available RIG in the United States.

Vaccines and Immune Globulins Used in Other Countries

Many developing countries use inactivated nerve tissue vaccines made from the brains of adult animals or suckling mice. Nerve tissue vaccine (NTV) is reported to induce neuroparalytic reactions among approximately 1 per 200 to 1 per 2,000 persons

vaccinated; suckling mouse brain vaccine (SMBV) causes reactions in approximately 1 per 8,000 persons vaccinated (*15,115*). The vaccines HDCV, PCEC, PDEV, and purified vero cell rabies vaccine (PVRV) (Table 6) are cell culture-derived and not of nerve tissue origin. In addition, unpurified antirabies serum of equine origin might still be used in some countries where neither RIG nor ERIG are available. The use of this antirabies serum is associated with higher rates of serious adverse reactions, including anaphylaxis.

Management of Adverse Reactions

Once initiated, rabies prophylaxis should not be interrupted or discontinued because of local or mild systemic adverse reactions to rabies vaccine. Usually, such reactions can be successfully managed with antiinflammatory and antipyretic agents, such as ibuprofen or acetaminophen.

When a person with a history of serious hypersensitivity to rabies vaccine must be revaccinated, antihistamines can be administered. Epinephrine should be readily available to counteract anaphylactic reactions, and the person should be observed carefully immediately after vaccination.

Although serious systemic, anaphylactic, or neuroparalytic reactions are rare during and after the administration of rabies vaccines, such reactions pose a serious dilemma for the patient and the attending physician (*9*). A patient's risk of acquiring rabies must be carefully considered before deciding to discontinue vaccination. Advice and assistance on the management of serious adverse reactions for persons receiving rabies vaccines may be sought from the state health department or CDC.

All serious systemic, neuroparalytic, or anaphylactic reactions should be reported to the Vaccine Adverse Event Reporting System (VAERS) via a 24-hour toll-free telephone number ([800] 822-7967).

PRECAUTIONS AND CONTRAINDICATIONS

Immunosuppression

Corticosteroids, other immunosuppressive agents, antimalarials, and immunosuppressive illnesses can interfere with the development of active immunity after vaccination (*41,116*). For persons with immunosuppression, preexposure prophylaxis should be administered with the awareness that the immune response might be inadequate (see Primary or Preexposure Vaccination). Patients who are immunosuppressed by disease or medications should postpone preexposure vaccinations and consider avoiding activities for which rabies preexposure prophylaxis is indicated. When this course is not possible, immunosuppressed persons who are at risk for rabies should be vaccinated by the IM route and their antibody titers checked. Failure to seroconvert after the third dose should be managed in consultation with appropriate public health officials (see Preexposure Vaccination and Serologic Testing).

Immunosuppressive agents should not be administered during postexposure therapy unless essential for the treatment of other conditions. When postexposure prophylaxis is administered to an immunosuppressed person, it is especially

important that a serum sample be tested for rabies antibody to ensure that an acceptable antibody response has developed.

Pregnancy

Because of the potential consequences of inadequately treated rabies exposure, and because there is no indication that fetal abnormalities have been associated with rabies vaccination, pregnancy is not considered a contraindication to postexposure prophylaxis (*117,118*). If the risk of exposure to rabies is substantial, preexposure prophylaxis might also be indicated during pregnancy.

Allergies

Persons who have a history of serious hypersensitivity to rabies vaccine should be revaccinated with caution (see Management of Adverse Reactions).

References

1. Krebs JW, Smith JS, Rupprecht CE, Childs JE. Rabies surveillance in the United States during 1996. J Am Vet Med Assoc 1997;211:1525–39.
2. Noah DL, Drenzek CL, Smith JS, et al. Epidemiology of human rabies in the United States, 1980 to 1996. Ann Intern Med 1998;128:922–30.
3. CDC. Human rabies — New Hampshire, 1996. MMWR 1997;46:267–70.
4. Mitmoonpitak C, Wilde H, Tepsumetanon W. Current status of animal rabies in Thailand. J Vet Med Sci 1997;59:457–60.
5. CDC. Human rabies — Montana and Washington, 1997. MMWR 1997;46:770–4.
6. CDC. Human rabies — Texas and New Jersey, 1997. MMWR 1998;47:1–5.
7. Krebs JW, Long-Marin SC, Childs JE. Causes, costs and estimates of rabies postexposure prophylaxis treatments in the United States. J Public Health Manage Pract 1998;4:57–63.
8. Bernard KW, Smith PW, Kader FJ, Moran MJ. Neuroparalytic illness and human diploid cell rabies vaccine. JAMA 1982;248:3136–8.
9. CDC. Systemic allergic reactions following immunization with human diploid cell rabies vaccine. MMWR 1984;33:185–7.
10. Dreesen DW, Bernard KW, Parker RA, Deutsch AJ, Brown J. Immune complex-like disease in 23 persons following a booster dose of rabies human diploid cell vaccine. Vaccine 1986;4: 45–9.
11. Aoki FY, Tyrrell DAJ, Hill LE, Turner GS. Immunogenicity and acceptability of a human diploid-cell culture rabies vaccine in volunteers. Lancet 1975;1:660–2.
12. Cox JH, Schneider LG. Prophylactic immunization of humans against rabies by intradermal inoculation of human diploid cell culture vaccine. J Clin Microbiol 1976;3:96–101.
13. Anderson LJ, Sikes RK, Langkop CW, et al. Postexposure trial of a human diploid cell strain rabies vaccine. J Infect Dis 1980;142:133–8.
14. Bahmanyar M, Fayaz A, Nour-Salehi S, Mohammadi M, Koprowski H. Successful protection of humans exposed to rabies infection. Postexposure treatment with the new human diploid cell rabies vaccine and antirabies serum. JAMA 1976;236:2751–4.
15. Hattwick MAW. Human rabies. Public Health Rev 1974;3:229–74.
16. Wiktor TJ, Plotkin SA, Koprowski H. Development and clincal trials of the new human rabies vaccine of tissue culture (human diploid cell) origin. Dev Biol Stand 1978;40:3–9.
17. WHO Expert Committee on Rabies, 7th report. Geneva: World Health Organization, 1984:1–104.
18. Kuwert EK, Werner J, Marcus I, Cabasso VJ. Immunization against rabies with rabies immune globulin, human (RIGH) and a human diploid cell strain (HDCS) rabies vaccine. J Biol Stand 1978;6:211–9.
19. Cabasso VJ, Loofbourow JC, Roby RE, Anuskiewicz W. Rabies immune globulin of human origin: preparation and dosage determination in non-exposed volunteer subjects. Bull World Health Organ 1971;45:303–315.

20. WHO Expert Committee on Rabies, 8th report. Geneva: World Health Organization, 1992;TRS 824.
21. Nicholson KG, Turner GS, Aoki FY. Immunization with a human diploid cell strain of rabies virus vaccine: Two year results. J Infect Dis 1978;137:783–8.
22. Bernard KW, Roberts MA, Sumner J, et al. Human diploid cell rabies vaccine: effectiveness of immunization with small intradermal or subcutaneous doses. JAMA 1982;247:1138–42.
23. Bernard KW, Mallonee J, Wright JC, et al. Preexposure immunization with intradermal human diploid cell rabies vaccine. Risks and benefits of primary and booster vaccination. JAMA 1987; 257:1059–63.
24. Fishbein DB, Pacer RE, Holmes DF, Ley AB, Yager P, Tong TC. Rabies preexposure prophylaxis with human diploid cell rabies vaccine: a dose-response study. J Infect Dis 1987;156:50–5.
25. CDC. Rabies prevention: supplementary statement on the preexposure use of human diploid cell rabies vaccine by the intradermal route. MMWR 1986;35:767–8.
26. CDC. Rabies vaccine, adsorbed: a new rabies vaccine for use in humans. MMWR 1988;37:217–8, 223.
27. Burgoyne GH, Kajiya KD, Brown DW, Mitchell JR. Rhesus diploid rabies vaccine (adsorbed): a new rabies vaccine using FRhL-2 cells. J Infect Dis 1985;152:204–10.
28. Levenbook IS, Elisberg BL, Driscoll BF. Rhesus diploid rabies vaccine (adsorbed): neurological safety in guinea pigs and Lewis rats. Vaccine 1986;4:225–7.
29. Berlin BS, Goswick C. Rapidity of booster response to rabies vaccine produced in cell culture. J Infect Dis 1984;150:785
30. Berlin BS, Mitchell JR, Burgoyne GH, Brown WE, Goswick C. Rhesus diploid rabies vaccine (adsorbed), a new rabies vaccine. II. Results of clinical studies simulating prophylactic therapy for rabies exposure. JAMA 1983;249:2663–5.
31. Berlin BS. Rabies vaccine adsorbed: neutralizing antibody titers after three-dose pre-exposure vaccination. Am J Pub Health 1990;80:476–8.
32. Dreesen DW, Fishbein DB, Kemp DT, Brown J. Two-year comparative trial on the immunogenicity and adverse effects of purified chick embryo cell rabies vaccine for pre-exposure immunization. Vaccine 1989;7:397–400.
33. Fishbein DB, Arcangeli S. Rabies prevention in primary care. A four-step approach. Postgrad Med 1987;82:83–90, 93–5.
34. LeGuerrier P, Pilon PA, Deshaies D, Allard R. Pre-exposure rabies prophylaxis for the international traveler: a decision analysis. Vaccine 1996;14:167–76.
35. Turner GS, Nicholson KG, Tyrrell DAJ, Aoki FY. Evaluation of a human diploid cell strain rabies vaccine: final report of a three year study of pre-exposure immunization. J Hyg Camb 1982;89:101–10.
36. Burridge MJ, Baer GM, Sumner JW, Sussman O. Intradermal immunization with human diploid cell rabies vaccine. JAMA 1982;248:1611–4.
37. Cabasso VJ, Dobkin MB, Roby RE, Hammar AH. Antibody response to a human diploid cell rabies vaccine. Appl Microbiol 1974;27:553–61.
38. CDC. Recommendation of the Immunization Practices Advisory Committee (ACIP). Supplemantary statement on preexposure rabies prophylaxis by the intradermal route. MMWR 1982; 31:279–85.
39. Sehgal S, Bhattacharya D, Bhardwaj M. Ten year longitudinal study of efficacy and safety of purified chick embryo cell vaccine for pre- and post-exposure prophylaxis of rabies in Indian population. J Commun Dis 1995;27:36–43.
40. CDC. Rabies prevention—United States, 1984. MMWR 1984;33:393–402, 407–8.
41. Pappaioanou M, Fishbein DB, Dreesen DW, et al. Antibody response to preexposure human diploid-cell rabies vaccine given concurrently with chloroquine. N Engl J Med 1986;314:280–4.
42. Bernard KW, Fishbein DB, Miller KD, et al. Pre-exposure rabies immunization with human diploid cell vaccine: decreased antibody responses in persons immunized in developing countries. Am J Trop Med Hyg 1985;34:633–47.
43. CDC and NIH. Biosafety in microbiological and biomedical laboratories. 3rd ed. Washington, D.C. HHS Publication No. (CDC) 93-8395, Washington, DC: U.S. Department of Health and Human Services, 1993.

44. Fishbein DB, Bernard KW, Miller KD, et al. The early kinetics of the neutralizing antibody response after booster immunizations with human diploid cell rabies vaccine. Am J Trop Med Hyg 1986;35:663–670.
45. Feder HM, Nelson R, Reiher HW. Bat bite? Lancet 1997;350:1300.
46. Afshar A. A review of non-bite transmission of rabies virus infection. Br Vet J 1979;135:142–8.
47. Winkler WG, Fashinell TR, Leffingwell L, Howard P, Conomy P. Airborne rabies transmission in a laboratory worker. JAMA 1973;226:1219–21.
48. Conomy JP, Leibovitz A, McCombs W, Stinson J. Airborne rabies encephalitis: demonstration of rabies virus in the human central nervous system. Neurology 1977;27:67–9.
49. Constantine DG. Rabies transmission by nonbite route. Pub Health Rep 1962;77:287–9.
50. Winkler WG, Baker EF, Hopkins CC. An outbreak of non-bite transmitted rabies in a laboratory animal colony. Am J Epidemiol 1972;95:267–77.
51. CDC. Rabies in a laboratory worker — New York. MMWR 1977;26:183–4.
52. CDC. Human-to-human transmission of rabies via corneal transplant — Thailand. MMWR 1981; 30:473–4.
53. Gode GR, Bhide NK. Two rabies deaths after corneal grafts from one donor. Lancet 1988;2:791
54. CDC. Human-to-human transmission of rabies via a corneal transplant — France. MMWR 1980; 29:25–6.
55. Houff SA, Burton RC, Wilson RW, et al. Human-to-human transmission of rabies virus by corneal transplant. N Engl J Med 1979;300:603–4.
56. WHO. Two rabies cases following corneal transplantation. Weekly Epidemiol Rec 1994;69:330.
57. Baer GM, Shaddock JH, Houff SA, Harrison AK, Gardner JJ. Human rabies transmitted by corneal transplant. Arch Neurol 1982;39:103–7.
58. Javadi MA, Fayaz A, Mirdehghan SA, Ainollahi B. Transmission of rabies by corneal graft. Cornea 1996;15:431–3.
59. Helmick CG, Tauxe RV, Vernon AA. Is there a risk to contacts of patients with rabies? Rev Infect Dis 1987;9:511–8.
60. Fekadu M, Endeshaw T, Wondimagegnehu A, Bogale Y, Teshager T, Olson JG. Possible human-to-human transmission of rabies in Ethiopia. Ethiop Med J 1996;34:123–7.
61. Garner JS, The Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. Infect Contr Hosp Epidemiol 1996;17:54–80.
62. Smith JS, Orciari LA, Yager PA, Seidel HD, Warner CK. Epidemiologic and historical relationships among 87 rabies virus isolates as determined by limited sequence analysis. J Infect Dis 1992;166:296–307.
63. National Association of State Public Health Veterinarians. Compendium of animal rabies control, 1998. J Am Vet Med Assoc 1998;212:213–7.
64. CDC. Rabies learning series: the removal of animal brains for rabies diagnosis [video tape]. Atlanta, GA: Centers for Disease Control and Prevention, 1997.
65. Childs JE, Colby L, Krebs JW, et al. Surveillance and spatiotemporal associations of rabies in rodents and lagomorphs in the United States, 1985–1994. J Wildl Dis 1997;33:20–7.
66. Krebs JW, Strine TW, Smith JS, Noah DL, Rupprecht CE, Childs JE. Rabies surveillance in the United States during 1995. J Am Vet Med Assoc 1996;209:2031–44.
67. Fishbein DB, Belotto AJ, Pacer RE, et al. Rabies in rodents and lagomorphs in the United States, 1971–1984: increased cases in the woodchuck (Marmota monax) in mid-Atlantic states. J Wildl Dis 1986;22:151–5.
68. Niezgoda M, Briggs DJ, Shaddock J, Dreesen DW, Rupprecht CE. Pathogenesis of experimentally induced rabies in domestic ferrets. Am J Vet Res 1997;58:1327–31.
69. CDC. Imported dog and cat rabies — New Hampshire, California. MMWR 1988;37:559–60.
70. Eng TR, Fishbein DB, National Study Group on Rabies. Epidemiologic factors, clinical findings, and vaccination status of rabies in cats and dogs in the United States in 1988. J Am Vet Med Assoc 1990;197:201–9.
71. Clark KA, Neill SU, Smith JS, Wilson PJ, Whadford VW, McKirahan GW. Epizootic canine rabies transmitted by coyotes in south Texas. J Am Vet Med Assoc 1994;204:536–40.
72. Griego RD, Rosen T, Orengo IF, Wolf JE. Dog, cat, and human bites: a review. J Am Acad Dermatol 1995;33:1019–29.
73. Smith JS, Fishbein DB, Rupprecht CE, Clark K. Unexplained rabies in three immigrants in the United States. A virologic investigation. N Engl J Med 1991;324:205–11.

74. Dreesen DW. A global review of rabies vaccines for human use. Vaccine 1997;15(Suppl):S2-6.
75. Dean DJ, Baer GM, Thompson WR. Studies on the local treatment of rabies-infected wounds. Bull World Health Organ 1963;28:477–86.
76. Kaplan MM, Cohen D, Koprowski H, Dean D, Ferrigan L. Studies on the local treatment of wounds for the prevention of rabies. Bull World Health Organ 1962;26:765–75.
77. CDC. Diphtheria, tetanus, and pertussis: recommendations for vaccine use and other preventive measures. Recommendations of the Immunization Practices Advisory Committee (ACIP). MMWR 1991;40(No. RR-10):1–29.
78. Khawplod P, Wilde H, Chomchey P, et al. What is an acceptable delay in rabies immune globulin administration when vaccine alone had been given previously? Vaccine 1996;14:389–91.
79. Helmick CG, Johnstone C, Sumner J, Winkler WG, Fager S. A clinical study of Merieux human rabies immune globulin. J Biol Stand 1982;10:357–67.
80. Wilde H, Sirikawin S, Sabcharoen A, et al. Failure of postexposure treatment of rabies in children. Clin Infect Dis 1996;22:228–32.
81. Fishbein DB, Sawyer LA, Reid Sanden FL, Weir EH. Administration of human diploid-cell rabies vaccine in the gluteal area. N Engl J Med 1988;318:124–5.
82. Nicholson KG. Rabies. Lancet 1990;335:1201–5.
83. Warrell MJ, Nicholson KG, Warrell DA, et al. Economical multiple-site intradermal immunisation with human diploid-cell-strain vaccine is effective for post-exposure rabies prophylaxis. Lancet 1985;1:1059–62.
84. Chutivongse S, Wilde H, Supich C, Baer GM, Fishbein DB. Postexposure prophylaxis for rabies with antiserum and intradermal vaccination. Lancet 1990;335:896–8.
85. Anderson LJ, Baer GM, Smith JS, Winkler WG, Holman RC. Rapid antibody response to human diploid rabies vaccine. Am J Epidemiol 1981;113:270–5.
86. Vodopija I, Sureau P, Lafon M, et al. An evaluation of second generation tissue culture rabies vaccines for use in man: a four-vaccine comparative immunogenicity study using a preexposure vaccination schedule and an abbreviated 2–1–1 postexposure schedule. Vaccine 1986;4:245–8.
87. Vodopija I, Sureau P, Smerdel S, et al. Comparative study of two human diploid rabies vaccines administered with antirabies globulin. Vaccine 1988;6:489–90.
88. Vodopija I, Sureau P, Smerdel S, et al. Interaction of rabies vaccine with human rabies immunoglobulin and reliability of a 2–1–1 schedule application for postexposure treatment. Vaccine 1988;6:283–6.
89. Seghal S, Bhattacharya D, Bhardwaj M. Five-year longitudinal study of efficacy and safety of purified Vero cell rabies vaccine for post-exposure prophylaxis of rabies in Indian population. J Commun Dis 1997;29:23–8.
90. Charanasri U, Meesomboon V, Kingnate D, Samuthananont P, Chaeychomsri W. Intradermal simulated rabies postexposure prophylaxis using purified chick embryo rabies vaccine. J Med Assoc Thai 1994;77:157–60.
91. Khawplod P, Glueck R, Wilde H, et al. Immunogenicity of purified duck embryo rabies vaccine (Lyssavac-N) with use of the WHO-approved intradermal postexposure regimen. Clin Infect Dis 1995;20:646–51.
92. Kositprapa C, Limsuwun K, Wilde H, Jaijaroensup W, et al. Immune response to simulated postexposure rabies booster vaccinations in volunteers who received preexposure vaccinations. Clin Infect Dis 1997;25:614–6.
93. Suntharasamai P, Chaiprasithikul P, Wasi C, et al. A simplified and economical intradermal regimen of purified chick embryo cell rabies vaccine for postexposure prophylaxis. Vaccine 1994;12:508–12.
94. Wilde H, Chutivongse S. Equine rabies immune globulin: a product with an undeserved poor reputation. Am J Trop Med Hyg 1990;42:175–8.
95. Wilde H, Chomchey P, Prakongsri S, Puyaratabandhu P, Chutivongse S. Adverse effects of equine rabies immune gobulin. Vaccine 1989;7:10–1.
96. Wilde H, Chomchey P, Punyaratabandhu P, Phanupak P, Chutivongse S. Purified equine rabies immune globulin: a safe and affordable alternative to human rabies immune globulin. Bull World Health Organ 1989;67:731–6.
97. Karliner JS, Belaval GS. Incidence of reactions following administration of antirabies serum. JAMA 1965;193:109–12.

98. CDC. Human rabies despite treatment with rabies immune globulin and human diploid cell rabies vaccine — Thailand. MMWR 1987;36:759–60, 765.
99. Shill M, Baynes RD, Miller SD. Fatal rabies encephalitis despite appropriate post-exposure prophylaxis. A case report. N Engl J Med 1987;316:1257–8.
100. Wilde H, Choomkasien P, Hemachudha T, Supich C, Chutivongse S. Failure of rabies post-exposure treatment in Thailand. Vaccine 1989;7:49–52.
101. Kuwert EK, Marcus I, Werner J, et al. Post-exposure use of human diploid cell culture rabies vaccine. Devel Biol Stand 1977;37:273–86.
102. Strady A, Lang J, Lienard M, Blondeau C, Jaussaud R, Plotkin S. Antibody persistence following preexposure regimens of cell-culture rabies vaccines: 10-year follow-up and proposal for a new booster policy. J Infect Dis 1998;177:1290–5.
103. Thraenhart O, Kreuzfelder E, Hillebrandt M, et al. Long-term humoral and cellular immunity after vaccination with cell culture rabies vaccines in man. Clin Immunol Immunopath 1994; 71:287–92.
104. Fishbein DB, Dreesen DW, Holmes DF, et al. Human diploid cell rabies vaccine purified by zonal centrifugation: a controlled study of antibody response and side effects following primary and booster pre-exposure immunizations. Vaccine 1989;7:437–42.
105. Briggs DJ, Schwenke JR. Longevity of rabies antibody titre in recipients of human diploid cell rabies vaccine. Vaccine 1992;10:125–9.
106. Corey L, Hattwick MAW, Baer GM, Smith JS. Serum neutralizing antibody after rabies post-exposure prophylaxis. Ann Intern Med 1976;85:170–6.
107. Rubin RH, Hattwick MAW, Jones S, Gregg MB, Schwartz VD. Adverse reactions to duck embryo rabies vaccine: range and incidence. Ann Intern Med 1973;78:643–9.
108. Noah DL, Smith MG, Gotthardt JC, Krebs JW, Green D, Childs JE. Mass human exposure to rabies in New Hampshire: exposures, treatment, and cost. Am J Pub Health 1996;86:1149–51.
109. Knittel T, Ramadori G, Mayet WJ, Lohr H, Meyer zum Buschenfelde KH. Guillain-Barré syndrome and human diploid cell rabies vaccine. Lancet 1989;1:1334–5.
110. Boe E, Nylan H. Guillain-Barré syndrome after vaccination with human diploid cell rabies vaccine. Scand J Infect Dis 1980;12:231–2.
111. Tornatore CS, Richert JR. CNS demyelination associated with diploid cell rabies vaccine. Lancet 1990;335:1346–7.
112. Anderson MC, Baer H, Frazier DJ, Quinnan GV. The role of specific IgE and beta-propiolactone in reactions resulting from booster doses of human diploid cell rabies vaccine. J Allergy Clin Immunol 1987;80:861–8.
113. Swanson MC, Rosanoff E, Gurwith M, Deitch M, Schnurrenberger P, Reed CE. IgE and IgG antibodies to beta-propiolactone and human serum albumin associated with urticarial reactions to rabies vaccine. J Infect Dis 1987;155:909–13.
114. Fishbein DB, Yenne KM, Dreesen DW, Teplis CF, Mehta N, Briggs DJ. Risk factors for systemic hypersensitivity reactions after booster vaccinations with human diploid cell rabies vaccine: a nationwide prospective study. Vaccine 1993;11:1390–4.
115. Held JR, Lopez Adaros H. Neurological disease in man following administration of suckling mouse brain antirabies vaccine. Bull World Health Org 1972;46:321–7.
116. Enright JB, Franti CE, Frye FL, Behymer DE. The effects of corticosteroids on rabies in mice. Can J Microbiol 1970;16:667–75.
117. Chutivongse S, Wilde H, Benjavongkulchai M, Chomchey P, Punthawong S. Postexposure rabies vaccination during pregnancy: effect on 202 women and their infants. Clin Infect Dis 1995;20:818–20.
118. Varner MW, McGuinness GA, Galask RP. Rabies vaccination in pregnancy. Am J Obstet Gynecol 1982;143:717–8.

The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available free of charge in electronic format and on a paid subscription basis for paper copy. To receive an electronic copy on Friday of each week, send an e-mail message to *listserv@listserv.cdc.gov*. The body content should read *SUBscribe mmwr-toc*. Electronic copy also is available from CDC's World-Wide Web server at *http://www.cdc.gov/* or from CDC's file transfer protocol server at *ftp.cdc.gov*. To subscribe for paper copy, contact Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone (202) 512-1800.

Data in the weekly *MMWR* are provisional, based on weekly reports to CDC by state health departments. The reporting week concludes at close of business on Friday; compiled data on a national basis are officially released to the public on the following Friday. Address inquiries about the *MMWR* Series, including material to be considered for publication, to: Editor, *MMWR* Series, Mailstop C-08, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30333; telephone (888) 232-3228.

All material in the *MMWR* Series is in the public domain and may be used and reprinted without permission; citation as to source, however, is appreciated.

☆U.S. Government Printing Office: 1998-733-228/87050 Region IV

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control
and Prevention (CDC)
Atlanta, Georgia 30333

Official Business
Penalty for Private Use $300
Return Service Requested

FIRST-CLASS MAIL
POSTAGE & FEES PAID
PHS/CDC
Permit No. G-284

The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available free of charge in electronic format and on a paid subscription basis for paper copy. To receive an electronic copy on Friday of each week, send an e-mail message to *listserv@listserv.cdc.gov*. The body content should read *SUBscribe mmwr-toc*. Electronic copy also is available from CDC's World-Wide Web server at *http://www.cdc.gov/* or from CDC's file transfer protocol server at *ftp.cdc.gov*. To subscribe for paper copy, contact Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone (202) 512-1800.

Data in the weekly *MMWR* are provisional, based on weekly reports to CDC by state health departments. The reporting week concludes at close of business on Friday; compiled data on a national basis are officially released to the public on the following Friday. Address inquiries about the *MMWR* Series, including material to be considered for publication, to: Editor, *MMWR* Series, Mailstop C-08, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30333; telephone (888) 232-3228.

All material in the *MMWR* Series is in the public domain and may be used and reprinted without permission; citation as to source, however, is appreciated.

☆U.S. Government Printing Office: 1998-733-228/87050 Region IV

UNITED STATES GOVERNMENT PRINTING OFFICE
SUPERINTENDENT OF DOCUMENTS
Washington, D.C. 20402

OFFICIAL BUSINESS
Penalty for Private Use, $300
Return Service Requested

BULK RATE
POSTAGE & FEES PAID
GPO
Permit No. G-26

Guidelines for Pre-exposure Rabies Immunization

The purpose of this information sheet is to help Indiana residents determine whether and when they should be pre-immunized for rabies. There are no **firm** statewide recommendations applicable to everyone. Based on potential exposure and rabies occurrence in the state, each person must determine whether pre-exposure prophylaxis would be beneficial. In addition to the information presented below, consultation with a physician, local health department, and the Indiana State Department of Health might be helpful in reaching an informed decision.

What is the current status of animal rabies in Indiana?

At present, Indiana is considered to have a low level of rabies activity in its wild and domestic animal populations. Over the last 25 years Indiana averaged about 10 rabid bats and 20 rabid skunks each year. However, there have been only 5 rabid skunks found in the state since 1990. The last rabid cat and dog were diagnosed in Indiana in 1984 and 1989, respectively. In spite of the low numbers of rabid animals, all wild carnivores (skunks, raccoons, foxes, and coyotes) and all bats that have exposed a human are considered rabid unless proven otherwise. Rodents and rabbits are almost always considered not rabid. The rabies potential of other species is assessed on an individual basis.

As the raccoon-variant rabies epidemic approaches Indiana from the east, this situation could change dramatically. States which have experienced raccoon-variant rabies have reported an increase in rabid animals, including wild carnivores, domestic animals, and even species that are not usually thought of as rabies candidates such as rabbits and deer. Although the raccoon variant epidemic is probably at least 2 years away, it is possible that a rabid raccoon could be transported, either intentionally or unintentionally, to Indiana at any time.

What is rabies pre-exposure prophylaxis?

Pre-exposure prophylaxis consists of 3 injections of rabies vaccine given intramuscularly or intradermally in the arm. The second injection is given I week after the first, and the third injection is given 2 or 3 weeks after the second. The primary purpose of pre-exposure prophylaxis is **not** to prevent rabies in exposed persons, although the process affords some degree of protection against unapparent exposures. The major benefit of pre-exposure prophylaxis is that when a pre-immunized person is exposed to rabies, complete protection can be achieved with just 2 booster shots 3 days apart. Exposed persons that have not been pre-immunized must receive rabies immune globulin plus 5 injections of vaccine over a period of four weeks. Thus the main benefit of pre-exposure prophylaxis is the rapidity with which immunity develops. Pre-immunized persons must still receive booster shots after every exposure.

Who should get pre-exposure prophylaxis?

Whether to get pre-immunized against rabies depends primarily on a person's exposure to potentially rabid animals and on the incidence of rabies in those animals. Taken together, these 2 factors determine a person's risk category. The chart labeled Table 3, found in " Rabies Prevention -- United States, 1991: Recommendations of the Immunizations Practices Advisory Committee (ACIP)" (CDC, Atlanta, GA.) describes four (4) risk categories and the populations that should be pre-immunized. As mentioned above, Indiana currently has a low level of rabies infection in animals (low rabies enzooticity). Thus, **veterinarians and their staff, animal control workers, and persons working with wildlife (biologists, trappers, relocators, rehabilitators, etc.)** would be considered to be in the "infrequent" category and should be pre-immunized. If and when raccoon-variant rabies reaches Indiana or the state experiences a large outbreak of skunk rabies (high rabies enzooticity), the above named populations would move to the "frequent" category. They would still need to be pre-immunized, but the recommendations for ensuring that an adequate

level of immunity is maintained are more rigorous, as explained in a later section. Persons in contact with healthy pets (groomers, trainers, etc.) and those who spend time in wildlife habitat (campers, hunters, etc.) do not need pre-exposure prophylaxis. However, this is an individual decision based on the risk of exposure and also on how much risk a person is willing to accept. No matter what the occurrence of rabies in a geographic area is, it is not recommended that members of the general public be pre-immunized.

Are there adverse reactions from receiving the vaccine?

The rabies vaccines available in the United States have been used around the world and found to be quite safe. After the 5 dose series, about 25 % of vaccinees reported local reactions such as pain, redness, and swelling. About 20% experienced mild systemic reactions such as headache, nausea, abdominal and muscle pain, and dizziness. The occurrence of severe allergic or anaphylactic reactions occurred in less than 1 % of vaccinees. There is a slight danger of " immune complex-like" reactions following repeated booster doses.

How can I get pre-exposure prophylaxis for myself and/or members of my organization?

Individuals can-get immunized by their private physician. Groups can receive pre-exposure prophylaxis from a variety of sources: private physicians, certain local health departments and hospitals, etc. The Occupational Health Unit at Methodist Hospital in Indianapolis will, for a reasonable fee, travel to anywhere in the state to vaccinate groups. The vaccine is available to health care providers from medical biologics distributors or from the 3 manufacturers (" Imovax " , Pasteur Merieux/Connaught Laboratories, 1-800-822-2463, " RabAvert " , Chiron Corporation, 1-800-244-7668, and Smith-Kline, 1-800-366-8900). The cost of pre-exposure prophylaxis depends on the route of administration (intradermal is cheaper) and the health care provider's markup and administration fees. Typical costs would be approximately $200 to $400 for the 3 dose series. Volume discounts for groups and negotiations with the providers may reduce the expense somewhat.

How do I know ff I am protected?

If you are in the " infrequent" risk category, you are considered to be adequately immunized just by receiving the 3 dose pre-exposure immunization series. If Indiana becomes a high enzootic area, then most pre-immunized persons would move to the "frequent" risk category. In that case, there are 2 options for ensuring adequate protection: boosters every 2 years or antibody titer determination every 2 years. Because there is a very small but real risk of immune complex development after repeated vaccinations, titer determination is the preferred method. Rabies antibody titers can be run at Kansas State University (913/532-5650) and Atlanta Health Associates (800/717-5612). If the titer falls below 1:5, then a booster is indicated. Remember that pre-exposure prophylaxis is not meant to offer complete protection from rabies infection. Two additional injections will still be needed after each exposure for pre-immunized persons.

Where can I get more information?

Physicians, local health departments and the Indiana State Department of Health (317/233-7272) are sources of additional information about risks of exposure and adverse reactions to the vaccine.