

A Fatal Case of Rabies in a Woman Bitten by an Insectivorous Bat

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RECOGNITION since 1953 of widespread rabies infection in insectivorous bats, native to the Western Hemisphere north of Mexico, has raised considerable conjecture regarding the potential of transmission to man and other animals and the role such a reservoir may play in the ecology and epidemiology of rabies (1-4). While the ecology of rabies in insectivorous bats is largely unknown, it is established that the virus may be present in the salivary glands and saliva (2, 4-10) and that some infected specimens may apparently harbor the virus as symptomless carriers (1, 2, 8, 11, 12). Whether this situation existed previously and is only now being recognized or is of recent origin is not known. Johnson (13) is of the opinion that rabies in bats is of recent origin. Since 1953, there have been numerous reports in the United States of persons being bitten by bats. Some of the animals have been rabid, some not rabid, and others were not secured for rabies examination.

Although epidemiological evidence has slowly accumulated incriminating insectivorous bats as a source of rabies infection for man (14-16) and while transmission from a naturally infected insectivorous bat to laboratory mice has been demonstrated (6), there has been no unequivocal evidence that rabid insectivorous bats have in-

fecting man or other animals in nature with the exception of the case to be described here.

A fatal case of rabies in a California woman definitely incriminates the silver-haired bat, *Lasiurus noctivagans*, a free-living, insectivorous species, as a source of the disease for man.

History of Exposure

On Saturday, August 30, 1958, a 53-year-old woman picked up a bat that was lying on the ground near the porch of her home in Magalia, Butte County, Calif. In attempting to place it in a tree where her two dogs would not further molest it, she was bitten on the middle finger of the left hand.

The bat apparently appeared abnormal, for she telephoned a veterinarian, Dr. W. H. Martin of Paradise, Calif., about treating the bat for a broken wing. Dr. Martin, upon hearing she had been bitten, suggested the bat might be rabid and advised the woman to refrigerate the animal and notify the Butte County Health Department. Because of the Labor Day weekend the health department was not notified until Tuesday, September 2.

The county health department laboratory examined the bat's brain and reported it positive for Negri bodies. A portion of the brain and the carcass of the bat were forwarded to the California State Department of Public Health. Identification of the bat and additional laboratory findings will be described later.

On the basis of the county laboratory's posi-

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tive findings, the woman was administered 3,000 units of hyperimmune antirabies serum intramuscularly late on September 2, the third day after she was bitten. The following day Dr. Wood began a course of rabies vaccine. The vaccine, of duck embryo origin (17-19), was administered in 14 daily injections.

At the time this treatment was initiated, the bite wounds consisted of two small healing punctures in the region of the second interphalangeal joint of the middle finger of the left hand. Local treatment was not administered because of the time interval between the bite and the healing of the wounds.

Eight days after administration of the antiserum and 7 days after the start of the vaccine therapy, the patient developed a skin rash with severe pruritis. Daily administration of the antihistaminic drug pyrilamine maleate was begun, and the next day strontium bromide with calcium gluconate was added to the therapy. However the rash persisted until shortly after the series of 14 doses of rabies vaccine was completed. At no time were members of the corticosteroid group of drugs administered.

The woman apparently remained well until October 24, 1958, when she went to a local chiropractor complaining of numbness in the inner left arm, extending to the first two fingers, and of pain in the region of the third thoracic vertebra. She returned with the same complaints the next day. On October 26, the pain descended to the fifth or sixth thoracic vertebra, and she complained also of gas and pressure below the diaphragm. From October 27 through 29, her chief complaint was abdominal pain. The chiropractor, as far as is known, was unaware of the bat incident.

The chiropractor became increasingly concerned about the possibility of an intestinal obstruction and repeatedly urged her to enter a hospital. On October 29 she visited Dr. Wood with the complaint of acute abdominal distress. She was treated symptomatically and told to return if she was no better in the morning. Since there was no improvement in her condition, she was admitted to a local hospital at 9:40 a.m., October 30. The diagnosis on admission was possible intestinal obstruction and notations of pain in upper left abdomen, intermittent for 10 days. On November 4 the woman

died, 66 days following exposure, 49 days after antirabies treatment had been completed, and 11 days after onset of symptoms. (See clinical history during hospitalization, p. 320.)

Laboratory Findings

An autopsy was performed approximately 13 hours after death. The only gross pathological finding was a 12-inch section of ileum, black in color and definitely delineated.

Bat and human brain material were submitted for further investigation to the virus and rickettsial disease laboratory, California State Department of Public Health, by the county health department. Findings are reported in full elsewhere (20) and are summarized here.

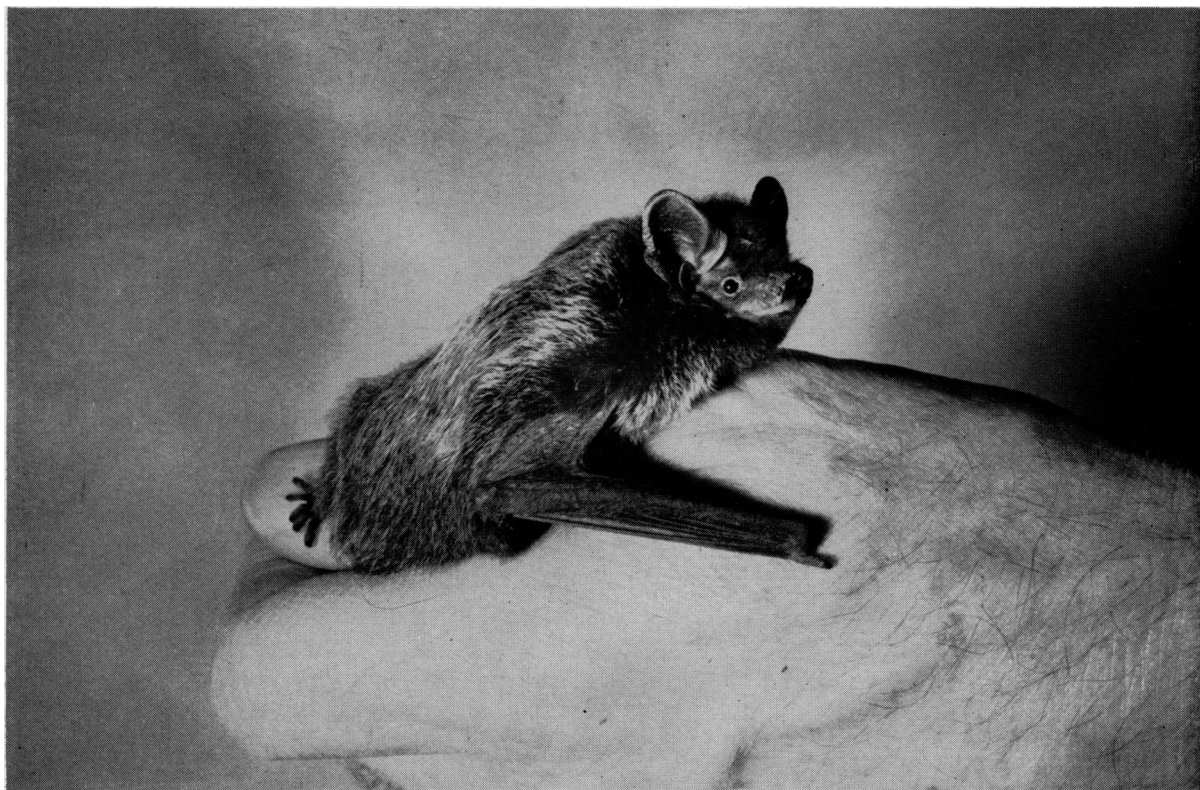
Microscopic examination of tissue impressions of the human brain material, stained by Sellers method (21), by the county health department and the State Department of Public Health, and examination of tissue sections by the State agency all revealed the presence of intracytoplasmic inclusion bodies not characteristic of Negri bodies. The histopathological picture was a diffuse nonsuppurative encephalomyelitis with the midbrain and brain stem especially affected.

Suspensions of the bat brain and the human brain material both proved infective for mice, and mouse brains all contained Negri bodies. The agent recovered from the human brain was further confirmed as rabies by serum neutralization test, using hyperimmune antiserum of equine origin.

Other Possible Exposures

The husband of the deceased woman told Dr. Kemp that he knew of no exposures experienced by his wife other than the bat incident. The two dogs that may have encountered the bat and two cats on the premises at the time of the incident were still in good health on March 3, 1959.

The husband recalled that he had observed fecal droppings on a porch of the house on most mornings during the summer prior to his wife's exposure. From his description, these appear to have been bat droppings, and the porch probably served as a night roosting site, perhaps for the moribund bat that his wife found. No



Photograph by Ernest P. Walker, National Zoological Park, Smithsonian Institution
Silver-haired bat (*Lasiycteris noctivagans*)

droppings were observed after the date of the biting incident.

During the winter, the husband stored boards in piles on the superstructure of his small sawmill, which is adjacent to the house. Early each spring when he moved the boards to spread them out over the superstructure of the mill for shade, he said that he frequently uncovered bats between the boards.

The Silver-Haired Bat

The carcass of the bat which had bitten the woman was identified as a silver-haired bat, *L. noctivagans*, by Keith F. Murray, mammalogist, bureau of vector control, California State Department of Public Health, and confirmed by Seth Benson, Ph.D., Museum of Vertebrate Zoology, University of California, Berkeley.

L. noctivagans (see photo), the only species in its genus, is distributed widely over the northern part of North America. It inhabits for-

ested areas and characteristically roosts under loose slabs of bark on trees. The species is infrequently encountered, although it is probably fairly common in suitable areas. Colonies have been found in the eastern part of the United States, but, in general, it is a solitary or free-living bat.

It is generally accepted to be a migratory species. In California, although there is no clear evidence of migration, scattered records suggest movement to lower elevations in winter. The observed distribution in California is primarily in the northern forest areas, the Sierra Nevada range, and along the coast south to Monterey County.

Butte County in northern California is divided into the Sierra foothills, which support open growths of blue oak woodland, Ponderosa pine forest beginning at 2,000 feet, and Douglas fir forest, beginning at 3,000 feet. There is a Ponderosa pine forest in the immediate vicinity

of the house where the biting incident took place. About 1 mile distant is a large, fresh-water reservoir.

L. noctivagans has been found to be rabid in at least two other recent instances. One oc-

curred in Osoyoos, British Columbia, in August 1958. A bat found in an old shoe bit a 75-year-old man on the thumb and index finger of the left hand. Brain tissue and salivary glands of the animal, a mature female silver-haired bat,

Clinical History During Hospitalization

First hospital day. Meperidine hydrochloride, an analgesic, phenothiazine chlorpromazine, a depressant, and secobarbital sodium, a sedative and hypnotic, were administered as required. Roentgenographic gastrointestinal studies revealed essentially negative findings. An electrocardiogram showed an abnormal picture which was interpreted as myocardial strain.

The results of blood studies follow:

Red blood	
count.....	4,650,000 (appears slightly hypochromic)
Hemoglobin.....	87 percent, 13.6 gm.
White blood	
count.....	16,300
Total polymorphonuclear leukocytes.....	91
Nonsegmented.....	1
Segmented.....	90
Eosinophiles.....	0
Basophiles.....	0
Total lymphocytes.....	5
Monocytes.....	4
Myelocytes.....	0

Temperature ranged from 96.8° to 98.0° F., pulse from 75 to 80, and respirations from 12 to 20 per minute.

Second hospital day. The patient complained of pain in the abdomen, arms, and back and was extremely restless. Urinary incontinence was noted, and she was reported to have been immodest before visitors. She was again given meperidine hydrochloride and phenothiazine chlorpromazine. Neostigmine, a parasympathetic nerve supply stimulant, phenobarbital, belladonna, and atropine were also administered. A urinalysis revealed largely negative findings with the exception of large amounts of acetone.

The patient's temperature ranged from 98.2° to 98.6° F., her pulse from 88 to 102, and respirations from 15 to 24 per minute.

Third hospital day. The patient had a good appetite for breakfast but ate little in the latter part

of the day. She had poor muscular control of the extremities and complained of pain in many parts of her body. She was again given meperidine hydrochloride, phenothiazine chlorpromazine, belladonna, and, in addition, acetophenetidin-acetylsalicylic acid-caffeine.

Fourth hospital day. The patient complained of severe pain, especially in the abdomen and down the legs. She ate well, however. Late in the day she became restless and tossed and turned a great deal. She was given meperidine hydrochloride, phenothiazine chlorpromazine, belladonna, secobarbital sodium, and phenobarbital.

The results of a spinal fluid examination were: appearance—clear; white blood count—none; protein—120 mg. percent; sugar—77 mg. percent; and Pandy test—positive.

Temperature ranged from 98.6° to 99.6° F., pulse from 70 to 100, and respirations were 20 per minute.

Fifth hospital day. The patient was extremely restless, complaining of pain in her stomach and inability to eructate and pass flatulence. She stated she was unable to feel hypodermic injections, yet complained of wrinkles in the bedsheets. She had less control of her extremities than on previous days but ate an evening meal. She was again given meperidine hydrochloride, phenothiazine chlorpromazine, and belladonna. Her temperature rose continuously from 99.8° at 7 a.m. to 102.2° F. at 7 p.m. Her pulse ranged from 96 to 112 and respirations were 20 to 34 per minute.

Sixth hospital day. The patient complained of abdominal distress and inability to swallow the mucus which ran almost continuously from her mouth. She also complained of a feeling of heaviness in her chest. She deteriorated rapidly in the afternoon. Temperature, pulse, and respirations all rose briefly in the early afternoon to 102.4° F., 120, and 30 per minute, respectively, and dropped just prior to death, which occurred at 6:30 p.m.

were inoculated into four mice each at the animal pathology laboratory, Canada Department of Agriculture, in Vancouver. Between the 11th and 14th postinoculation day, all mice were dead. Microscopic examination revealed typical Negri bodies (5).

Another silver-haired bat, submitted from Pueblo, Colo., in 1959, was reported positive by the South West Rabies Investigation Station, Las Cruces, N. Mex. (22).

Rabies in Nonsanguivorous Bats

Prior to 1953 rabies in bats was believed limited to the geographic areas inhabited by the vampire bat—Mexico, Central and South America, and Trinidad (23). Although a few isolations had been made from frugivorous and insectivorous species of bats in Brazil (24) and Trinidad (25), these were considered to be infections related to the vampire reservoir and were thought to play no role in the spread of the disease.

The first identification of rabies in a nonsanguivorous bat in the United States was made from a Florida yellow bat, *Dasypterus floridanus* (12,26). The bat was killed while unprovokedly biting a 7-year-old boy in daylight on June 24, 1953, in Florida. On September 23, 1953, a bat attacked a woman standing at a lake front in Boiling Springs, Pa. (27,28). The carcass was inadvertently destroyed but it is believed to have been a hoary bat, *Lasiurus cinereus*. In both instances the bats were confirmed as rabid by laboratory examination. Both persons received antirabic treatment and remained well.

Haupt and Rehaag (24) reported a leaf-nosed bat, *Phyllostoma superciliatum*, biting a calf which later developed paralytic rabies. Bell (6) achieved transmission of rabies by the bite of a naturally infected California myotis bat, *Myotis californicus*, on three of a litter of six mice.

Since the initial isolation of rabies virus from an insectivorous bat in Florida in 1953 (12,26), rabies has been identified in nearly 300 bats of 19 bat species, 4 solitary and 15 colonial, from 19 States in widely divergent areas of the United States (personal communication from E. S. Tierkel, Communicable Disease Center,

April 30, 1959). The greatest number of isolations has been made in the southwest.

Bat-Associated Rabies in Humans

While the transmission of rabies infection from the vampire bat to man has been well authenticated (25), we are aware of only five reported instances of rabies in humans associated with insectivorous bats other than the case reported here. The first case, reported by Sulkin and Greeve (14), was in a 43-year-old woman who died of rabies in Texas in 1951. She stooped to look at a bat lying at the side of a road near her home. The bat flew up and bit her on the left forearm. Sixteen days later she became ill. She was admitted to a hospital 5 days later with a diagnosis of bulbar poliomyelitis. She died on the fourth day she was in the hospital. Negri bodies were observed on microscopic examination of brain tissue. The bat was neither identified nor examined for rabies.

The second case occurred in India (15). A railway worker, 48 years old, noticed some boys pelting a bat with stones. He was bitten viciously on the forearm when he attempted to place the bat in a tree. He went to a physician 3 months later complaining of malaise and difficulty in swallowing. He had a temperature of 100°F. His condition deteriorated rapidly and he died on May 24, 1954. The species of bat was not identified nor was it examined for rabies.

The third case, reported by Irons and co-workers (16), was in a Texas State Health Department entomologist who died of rabies on January 4, 1956. He had been engaged in research on bat rabies in Texas, capturing, handling, and banding insectivorous bats in caves from April through November 1955. Isolation of rabies virus had been made from bats taken from the caves where he had worked. He had also inoculated bats with rabies virus several months before his death. How and when he was infected even he did not know. He is known to have worked extensively, however, in Frio Cave, Uvalde County, a cave which figures prominently in the history of the fourth case. Rabies infection in the entomologist was confirmed by positive mouse inoculation test.

The cause of death in the fourth case has been

Rabid bats found in California, January 1, 1954—December 31, 1959

Year, month, and county	Species	Results of mouse inoculation test	Remarks
1954			
July, Sonoma-----	<i>Tadarida brazil- iensis.</i>	Combined brain and sal- ivary gland tissues positive.	Survey specimen, apparently healthy, collected near Forrestville.
1955			
June, Kern-----	<i>Myotis californicus</i> ---	Salivary gland tissue posi- tive, brain liquified, not examined.	Found dead in fish pond at Camp Yenisey Hante on Green Horn Mountain.
September, Madera--	<i>Tadarida brazil- iensis.</i> ¹	Brain and salivary gland positive.	Bat observed in tree by man pruning tree in Madera. Man bitten capturing bat. Bat dead next morning. Brain Negri negative. Neutraliza- tion test positive.
1956			
August, Santa Clara--	<i>Myotis species</i> ¹ -----	Brain tissue positive-----	Bat unprovokedly attacked boy and grandfather in patio of home in Los Gatos about 5:30 p.m. Boy bitten behind ear.
September, Shasta---	<i>Lasiurus cinereus</i> -----	Brain tissue positive-----	Apparently paralyzed bat observed on porch steps of home in East Redding. Dog possibly bitten. Negri positive.
September, Shasta---	<i>Tadarida brazil- iensis.</i>	Brain tissue positive-----	Partially paralyzed bat observed at noon crawling across floor of motor- cycle shop in Redding. Negri nega- tive.
October, Butte-----	<i>Lasiurus cinereus</i> -----	Brain tissue positive-----	Partially paralyzed bat found in yard of home in Chico. Negri negative.
1957			
July, Madera-----	<i>Tadarida brazil- iensis.</i> ¹	Brain tissue positive-----	Apparently partially paralyzed bat observed to fall out of tree on a ranch. Negri negative. Neutraliza- tion test positive.
September, Madera--	<i>Myotis evotis</i> -----	Brain tissue positive-----	Bat scared off ground during daytime in Agnew Meadows, High Sierras. Lit on nearby tree, then lit on second tree. Man bitten capturing bat. Negri negative.
1958			
April, Shasta-----	<i>Tadarida braziliensis</i> ---	(?)-----	Partially paralyzed bat found lying on porch of county health department below known bat roost in roof tiles. Negri positive. Neutralization test positive.
June, Butte-----	<i>Tadarida brazil- iensis.</i> ¹	Brain tissue positive-----	Two dogs observed playing with parti- ally paralyzed bat in yard of home in Thermalito. Not known if dogs bitten. Negri negative.
August, Butte-----	<i>Lasionycterus noctivagans.</i>	Brain tissue positive-----	Partially paralyzed bat picked up by woman who was bitten and sub- sequently died of rabies. Negri posi- tive.
September, Butte---	<i>Lasiurus cinereus</i> -----	(?)-----	Partially paralyzed bat found in yard of home in Chico. Negri positive.
July, Alameda-----	<i>Tadarida braziliensis</i> ---	Brain tissue positive-----	Partially paralyzed or dead bat found by 7-year-old boys in Berkeley. Boys incurred skin punctures, but not known if due to bite. Negri negative.
July, Kern-----	<i>Tadarida braziliensis</i> ---	Brain tissue positive-----	Paralyzed bat found under bat roost in Kern Canyon. Died next day. Negri negative. Neutralization test posi- tive.

Rabid bats found in California, January 1, 1954—December 31, 1959—Continued

Year, month, and county	Species	Results of mouse inoculation test	Remarks
November, Kern	<i>Lasiurus cinereus</i>	Brain tissue positive	Partially paralyzed bat found by three children in Bakersfield. Children apparently not bitten. Negri negative.
December, Imperial	<i>Macrotus californicus</i>	Brain tissue and saliva positive.	Apparently healthy bat collected in survey from mine near Potholes. Neutralization test positive.
1959			
April, Alameda	<i>Tadarida brasiliensis</i>	Brain tissue positive	Partially paralyzed bat found during daytime floundering on garage floor of home in Centerville area. Negri negative.
May, Kern	<i>Lasiurus cinereus</i>	Brain tissue positive	Three of 13 apparently ill or abnormal bats captured at the Naval Ordnance Test Station, Ridgecrest, Inyokern, during daytime or early evening. All Negri positive.
May, Kern	<i>Lasiurus cinereus</i>	Brain tissue positive	
June, Kern	<i>Antrozous pallidus</i>	Brain tissue positive	
June, Marin	<i>Antrozous pallidus</i>	(²)	Two cats found playing with a partially paralyzed adult bat on front porch of home in San Rafael at 3 a.m. Bat bit one cat. Negri positive.
June, Marin	<i>Antrozous pallidus</i>	(²)	Partially paralyzed young adult bat found being played with by dog in yard of home in San Rafael during evening. Negri positive.
June, Marin	<i>Antrozous pallidus</i>	(²)	Young bat just beginning to fly found dead under bush by dog in yard of San Rafael home. Negri positive.
August, Marin	<i>Antrozous pallidus</i>	Brain tissue positive	Partially paralyzed young adult bat found being played with by cat in patio of San Rafael home at noon. Microscopic examination atypical.
June, Napa	<i>Antrozous pallidus</i>	(²)	Partially paralyzed bat found on ranch near Calistoga. Negri positive.
July, Napa	<i>Tadarida brasiliensis</i>	Brain tissue positive	Partially paralyzed bat found near Calistoga. Microscopic examination atypical.
July, Butte	<i>Lasiurus cinereus</i>	(²)	Partially paralyzed bat found by ranger in Bidwell Bar State Park near Oroville. Negri positive.
July, Butte	<i>Pipistrellus hesperus</i>	Brain tissue positive	Partially paralyzed bat found in swimming pool of Butte County Hospital, Oroville, by child. Child picked up bat and was bitten. Microscopic examination atypical.
September, Butte	<i>Tadarida brasiliensis</i>	Brain tissue positive	Bat found being played with by cat in Chico home. Cat bitten. Microscopic examination negative.
July, Modoc	<i>Pipistrellus hesperus</i> ¹	Brain tissue positive	Partially paralyzed bat found in yard of home in Alturas. Negri negative.
August, Shasta	<i>Tadarida brasiliensis</i>	Brain tissue positive	Partially paralyzed bat found alive on front step of home in Redding. Microscopic examination atypical.
September, Glenn	<i>Tadarida brasiliensis</i>	Brain tissue positive	Partially paralyzed bat found on step of school in Willows by school child. Microscopic examination atypical.
September, Ventura	<i>Lasiurus cinereus</i>	(²)	Bat made unprovoked attack upon dog in daytime in home at Fillmore. Negri positive.
October, San Joaquin	<i>Tadarida brasiliensis</i>	Brain tissue positive	Found moribund in street in Tracy.

¹ Identification of species probable.

² Results of mouse inoculation test not available.

confirmed but how the infection was incurred is not clear (29). A consultant mining engineer died of rabies in Wadsworth Veterans Administration Hospital, West Los Angeles, Calif., on June 3, 1959. He is known to have explored bat caves in the Big Bend country of Texas as possible locations for mining bat guano. Between April 17 and 28, 1959, he visited Hawkey Cave, Pecos County; Frio Cave, Uvalde County; Fern Cave, Val Verde County; and Dunbar Cave, Edwards County.

He told a friend that in one cave, believed to be Frio Cave, the bats were very numerous and he had had to hold his flashlight above his head to protect himself. During this time a bat nicked him in the face. However, prior to death he was emphatic in denying that he had been bitten by a bat or other animal. He also visited Mexico during the periods April 9-14 and May 11-14, but is thought not to have visited bat caves there.

On May 26 he became nauseated and vomited, and complained of pain in his left hand and arm. He was admitted to the hospital June 1.

The clinical history following hospitalization is one of dyspnea, Cheyne-Stokes respiration, periods of depression, continuous retching, hypersensitivity, anxiousness, sweating hydrophobia, rapid deterioration, and death. Temperature was just above normal on hospital admittance and reached 103° F. terminally. A clinical diagnosis of rabies was reached early on June 2. Death occurred on June 3.

Microscopic examinations of brain material by the Los Angeles City Health Department and the University of California at Los Angeles Medical School were negative for Negri bodies. Mouse inoculation tests by both laboratories revealed a pathogenic agent, which killed the mice in 6 days, but examination of the mouse brains failed to reveal Negri bodies. The identity of the mouse pathogenic agent as rabies virus was confirmed by positive serum neutralization tests in mice and the finding of Negri bodies in the brains of second passage mice.

The fifth case occurred in a 44-year-old man in Wisconsin (30a). On August 8, 1959, a sleeping farmer in Blue River was bitten on the lobe of the right ear by a bat that flew in the window. On August 29 he complained of tingling and pain in the area of the right ear.

He died on the morning of September 4, 1959. Microscopic examination of brain tissue taken at autopsy revealed Negri bodies and mouse inoculation test was positive for rabies. The bat incident was the farmer's only known contact with a possible rabies vector. The bat was not identified or examined for rabies because it was eaten by the family cat.

Bat Rabies as a Public Health Hazard

Evaluation of the role of bat rabies in the epidemiology and ecology of the disease in the United States is extremely difficult. Despite the widespread reservoir of the disease in bats the evidence of transmission from bats to terrestrial animals is negligible.

The direct public health hazard of rabies in bats is likewise somewhat difficult to evaluate. cursory review of various reports of human exposures in this country and Canada indicates at least 75 persons have been reported to have been bitten (31). The actual number of persons bitten by bats certainly is greater than the reported figures indicate. In the majority of reports which include the circumstances of the bite the bitten persons subjected themselves to exposure through handling an abnormal- or ill-appearing bat.

Few reports (6, 12, 14, 26-28, 30) indicate unprovoked attack. These circumstances closely parallel experience in California (see table).

The first recognition of bat rabies in California was made in 1954 (11). Subsequent recognitions have brought the total number to 35, comprising at least 8 species from 14 counties.

Two of the 35 were apparently normal specimens collected in surveys. Two were found dead, one in a fishpond and one on the ground. Twenty-eight were ill, partially paralyzed or moribund when found. One was disturbed, during daylight, on the ground by the bitten person.

Only two bats made unprovoked attacks, one on a boy and his grandfather and one on a dog.

Of persons exposed in California, five (three adults and two children) are definitely known to have been bitten; two children may possibly have been bitten; and three children were contacts, but apparently not bitten. Eleven do-

mestic pets (seven dogs and four cats) have been contacts to rabid bats in California. With but one exception, all persons bitten in California exposed themselves by handling bats which exhibited signs of abnormality, such as partial paralysis.

A total of 92 cases of rabies in humans were reported in the United States during the 8-year period 1951-58, of which only 3 were associated with exposure to bats, an incidence of about 3 percent. Thus, the available evidence indicates the hazard of direct transmission of rabies from bats to man is minor compared with that of transmission from terrestrial animals.

Discussion of the Case History

The woman in the case history related earlier received what is usually considered to be an adequate course of antirabic treatment (32), initiated within 3 days after exposure. Despite the treatment, she succumbed to rabies 66 days following exposure and 49 days after completion of treatment. The case clearly represents an instance of treatment failure. The nature of the bite wounds and the size of the animal to which she was exposed would seem to preclude the possibility of implantation of an overwhelming inoculum of rabies virus. There is nothing in the woman's past history to suggest undue susceptibility to infection, such as agammaglobulinemia.

Summary

On August 30, 1958, a woman was bitten on a finger of the left hand by a silver-haired bat (*Lasionycteris noctivagans*) near Magalia, Butte County, Calif. The woman was bitten during unnecessary handling of the bat which behaved abnormally. The animal was proved rabid by the finding of Negri bodies in impressions of bat brain material and isolation of rabies virus by mouse inoculation. The patient was administered what is usually considered to be an adequate course of antirabies treatment, initiated on the third day following exposure. Treatment consisted of 3,000 units of hyperimmune antirabies serum followed by 14 doses of rabies vaccine of duck embryo origin. Although treatment was complicated by a skin rash, the

woman remained well until October 24, 1958, when she complained of numbness in the left arm and fingers and of pain between her shoulders. Her condition gradually deteriorated, becoming complicated by an ascending paralysis. Death occurred on November 4, 1958. Rabies virus was isolated from her brain and identified by serum virus neutralization test. The case constitutes an instance of antirabies treatment failure.

The case is believed to be the first fully documented instance of transmission of rabies from nonsanguivorous bat to man.

Present knowledge of the extent of the insectivorous bat rabies reservoir in the United States and five other human cases of rabies associated with insectivorous bats are reviewed. The public health hazard of rabies in insectivorous bats is discussed.

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