

What about Bats?

The other rabies reservoir species



History of Bat Rabies

- Summer 1953, Tampa FL
 - A boy searching for a baseball in bushes was bitten by a yellow bat (*Lasiurus intermedius*) on the chest
 - Homeowner had heard of vampire bat rabies in SA, had this bat tested, negri bodies identified
 - Boy received rabies PEP and survived

More States Test Bats

- By 1960 rabid bats identified in 30 states
- By 1965 rabid bats constituted more than 10% of all rabid animals identified in the US
- Today rabid bats constitute less than 5% of all rabid animals
- Bat rabies was not expanding in the 60's, it had just never been looked for...

Are Bats the Source of Carnivore Rabies?

- It is likely they are
- Rabies was undetected in terrestrial wildlife of northern Arizona until 2001, when rabies was diagnosed in 19 rabid skunks in Flagstaff. Laboratory analyses showed causative rabies viruses associated with bats, which indicated cross-species transmission of unprecedented magnitude
 - Leslie, et. al. Bat-associated Rabies Virus in Skunks, *Emerging Infectious Diseases* • www.cdc.gov/eid • Vol. 12, No. 8, August 2006

Host Switching in *Lyssavirus* History from the Chiroptera to the Carnivora Orders

- Badrane, Tordo. *J Virology*. Sept. 2001, p. 8096–8104
- RNA viruses having a polymerase devoid of a proofreading mechanism are the fastest-evolving organisms. They produce a diverse viral population, i.e., quasispecies, ready to explore new conditions or escape defense systems.
- Phylogenetic reconstruction strongly supported the hypothesis that host switching occurred in the history of lyssaviruses
- The emergence of carnivoran rabies from chiropteran lyssaviruses was determined to have occurred 888 to 1,459 years ago

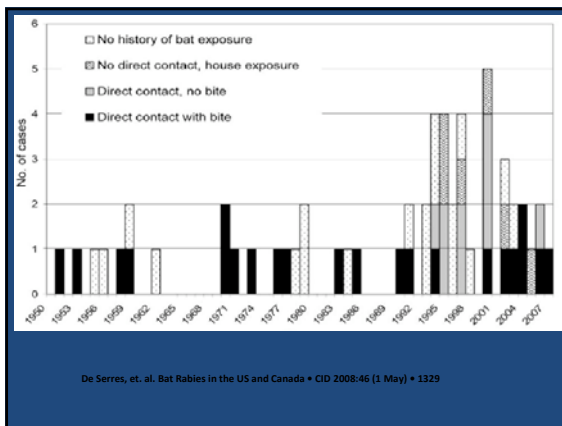
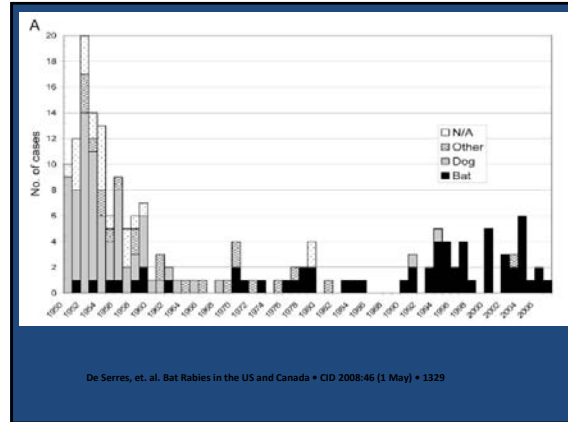
Bats (non hematophagous) Seem to be the Source of Numerous Viruses

- Hendra & Nipah virus
 - EID • www.cdc.gov/eid • Vol. 11, No. 12, December 2005
 - *Microbes and Infection*, 3, 2001, 277–278
 - *Microbes and Infection*, 3, 2001, 307–314
- Tioman virus
 - *Virology* 283, 215-229 (2001)
- SARS
 - 28 October 2005 Vol 310 *Science*, 673-679

Vampire Bats and Rabies



- A problem throughout Latin America, but not the US and Canada.
- Panama, 1514, Fernandez de Oviedo wrote that many soldiers died from bat bites
- Yucatan, 1527, Francisco de Montejo reported vampire bats attacked troops and cattle
- By the 1960's over 510,000 cattle died annually of "bovine paralytic rabies" from vampires throughout LA

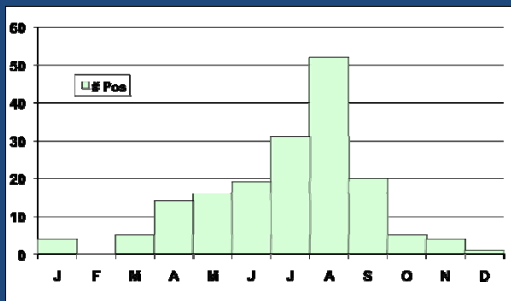


Human Rabies, Bat Variant, US, 1990-2007 n = 34

- 6 cases – bite reported
- 2 cases – physical contact reported
- 15 cases – bat documented in living space, no contact, no bite
- 11 cases – no bat encounter at all

MMWR Recommendations & Reports May 23, 2008 / 57(RR03);1-26,28

Seasonality of Positive Bats in NC, 2002-2006 (n=171)



Why do Bats Pose Such a risk?

- The virus from bats can replicate at a lower temperature, thus small superficial wounds from bat bites can lead to infection
 - Characterization of a Unique Variant of Bat Rabies Virus Responsible for Newly Emerging Human Cases in North America. *Proc Natl Acad Sci USA* 1996;93:5653-5658
 - And / Or
 - Bat bites are not dramatic and may not be appreciated when they occur or when the patient is examined
 - Some may recognize the bite but not comprehend its implications
 - Others, such as young persons or those with disabilities may be unable to provide an accurate history of a bite
- Prophylaxis Against Rabies. *NEJM* 2004; 351:2626-2635

Why do Bats Pose Such a Risk?



The image to the left demonstrates minor puncture wounds from a bat bite (arrows point to wounds).

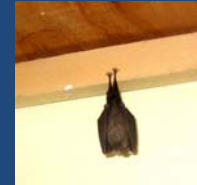
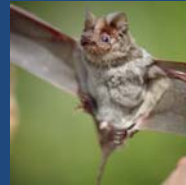
Reprinted with permission from Massachusetts Medical Society: N Engl J Med 2004;351:2626-35.



Human Rabies – WA, 1995

www.cdc.gov/mmwr/preview/mmwrhtml/00038616.htm

- In situations in which **a bat is physically present & the person(s) cannot exclude the possibility of a bite**, post-exposure treatment should be considered unless prompt testing of the bat has ruled out rabies infection.



1999 ACIP - Human Rabies Prevention

<http://www.cdc.gov/mmwr/preview/mmwrhtml/00056176.htm>

- 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 post-exposure 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.
- Post-exposure 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.

1999 ACIP - Human Rabies Prevention

<http://www.cdc.gov/mmwr/preview/mmwrhtml/00056176.htm>

- In instances in which a bat is found indoors...
 - Post-exposure 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.
 - Post-exposure prophylaxis would not be warranted for other household members.

Bats of North Carolina

Federally Listed Endangered Species

- Little Brown Bat
- Southeastern Myotis
- Gray Myotis
- Keen's Myotis
- Indiana Myotis
- Small Footed Myotis
- Silver Haired Bat
- Eastern Pipistrelle
- Big Brown Bat
- Red Bat
- Seminole Bat
- Hoary Bat
- Evening Bat
- Townsend's Big Eared Bat
- Rafinesque's Big Eared Bat
- Brazilian Free Tailed Bat
- Myotis lucifugus*
- Myotis austroriparius*
- Myotis grisescens*
- Myotis keenii*
- Myotis evotis*
- Myotis leibii*
- Lasiorycteris noctivagans*
- Pipistrellus subflavus*
- Eptesicus fuscus*
- Lasiurus borealis*
- Lasiurus seminolus*
- Lasiurus cinereus*
- Nycticeius humeralis*
- Plecotus townsendii*
- Plecotus rafinesquii*
- Tadarida brasiliensis*

Bats Submitted to NC SLPH for Rabies Testing, 2002-2005

Species	# Submitted	# Positive	% Positive
<i>E. fuscus</i>	3248	74	2.3
<i>L. borealis</i>	291	35	12.0
<i>L. noctivagans</i>	117	2	1.7
<i>T. brasiliensis</i>	108	6	5.5
<i>N. humeralis</i>	98	2	2.0
<i>P. subflavus</i>	16	3	19.0
<i>L. seminolus</i>	12	1	8.3
<i>L. cinereus</i>	4	1	25.0
<i>C. rafinesquii</i>	2	0	-
Totals	3896	124	3.2

Note: 240 samples were submitted that were not specified; Four were positive