



Bio Vet Innovator Magazine

(Fueling The Future of Science...)

Volume 3 (Issue 9) SEPTEMBER 2026

OPEN ACCESS

World Rabies Day – 28th September 2026

Popular Article

Hibernation and Rabies: Can an Animal Sleep Through a Viral Infection?

Sonali D. Chandankar¹, Roshan M. Sarode², Vaidehi D. Chandankar³

¹PhD Scholar, Department of Poultry Science,

GBPUAT University, Pantnagar, Uttarakhand

²MVSc Scholar, Department of Animal Nutrition,

ICAR-Indian Veterinary Research Institute, Bareilly, Uttar-Pradesh

³PhD Scholar, Department of Veterinary Microbiology,

ICAR-Indian Veterinary Research Institute, Bengaluru, Karnataka, India

*Corresponding Author: chandankarvaidehi@gmail.com

DOI: <https://doi.org/10.5281/zenodo.23123091>

Received: September 30, 2026

Published: October 03, 2026

© All rights are reserved by Vaidehi D. Chandankar

Abstract:

Rabies is a fatal viral disease whose persistence in wildlife is closely linked to the biology of its hosts. Hibernating bats provide an unusual example of how seasonal changes in host physiology can influence viral infection. During hibernation, reduced body temperature and metabolic activity can alter viral multiplication and prolong the incubation period. Experimental studies have demonstrated that rabies virus can overwinter in infected bats, while ecological modelling suggests that hibernation, prolonged incubation and seasonal reproduction may contribute to viral maintenance between transmission seasons. This article explores how the physiology of hibernation influences rabies infection and highlights the relationship between host biology, viral persistence and seasonal disease ecology.

The Unusual Host — Why Bats Matter in Rabies:

Rabies is primarily a disease of mammals, but its ecology in wildlife is more complex than the typical picture of infection followed by rapid disease progression. Bats are important hosts of rabies virus and other lyssaviruses, and their physiology and seasonal behaviour can influence viral persistence (Calisher et al., 2006).

Many temperate-zone bats undergo torpor or hibernation during colder periods. Body temperature and metabolic activity decrease substantially, allowing bats to conserve energy when food availability is limited. This creates an unusual biological environment for a virus that depends on host cells for replication. The question is therefore not simply whether bats can carry rabies, but whether their seasonal physiology can influence when an infection progresses.

Ecological modelling by George et al. (2011) suggested that prolonged incubation, seasonal mortality and hibernation may contribute to the maintenance of rabies virus in some bat populations. Infected bats surviving through winter could potentially carry infection into the following period of

Citation: Sonali D. Chandankar, Roshan M. Sarode and Vaidehi D. Chandankar. (2026). Hibernation and Rabies: Can an Animal Sleep Through a Viral Infection? In Bio Vet Innovator Magazine (Vol. 3, Issue 9, pp. 135–138). Bio Vet Innovator Magazine. <https://doi.org/10.5281/zenodo.23123091>

activity, when transmission opportunities increase again.

Thus, the importance of bats in rabies ecology lies not only in their ability to harbour the virus, but also in the way their seasonal biology may influence its persistence.

When the Body “Switches Down” — What Happens During Hibernation?

Hibernation is different from ordinary sleep. During torpor, bats undergo a marked reduction in metabolic rate and body temperature, accompanied by slower heart rate and respiration. Periodic arousals allow them to temporarily return to a warmer and more active physiological state. For an infection, these changes are important because the internal environment of the host is no longer constant. A virus present in an active animal encounters a very different physiological environment from one present during deep torpor.

Experimental evidence demonstrates that temperature can influence rabies infection. Sulkin et al. (1960) observed little or no viral multiplication during experimentally induced hibernation in infected insectivorous bats. Their observations showed that the low-temperature state associated with hibernation could markedly alter viral activity.

Davis et al. (2016) later investigated overwintering of rabies virus in silver-haired bats (*Lasionycteris noctivagans*). Experimentally infected bats maintained under hibernation conditions for six weeks were able to carry the infection through the experimental period, and their incubation period was extended compared with bats maintained at ambient temperature.

These findings demonstrate that the physiological state of the host can influence the timing of rabies infection.

Rabies in Slow Motion — Temperature, Metabolism and Viral Replication:

Rabies virus depends entirely on host cells for replication. It uses cellular machinery to produce viral RNA and proteins and to complete its replication cycle. Consequently, changes in the physiological condition of the host can influence the environment in which viral replication occurs.

Temperature affects numerous cellular processes, including enzymatic reactions and protein synthesis. When body temperature falls substantially during hibernation, these processes occur under conditions very different from those in an active animal. This provides a biological explanation for the reduced viral multiplication observed during experimental hibernation. Rather than completely eliminating the virus, the low-temperature state can alter the pace of infection. The distinction between viral persistence and active replication is important. Reduced viral multiplication does not necessarily mean that the infection has disappeared. Instead, viral activity may remain sufficiently limited for the infection to persist while the host remains in a low-temperature physiological state.

Therefore, temperature acts not merely as an environmental factor but as part of the biological environment in which the virus interacts with its host. This interaction can influence the timing of viral

development and, ultimately, disease progression.

The Winter Mystery — Survival, Incubation and Transmission:

The effect of hibernation becomes particularly interesting when infection is considered over an entire winter.

Rabies has a variable incubation period, and several factors can influence the time between infection and clinical disease. In hibernating bats, the physiological state of the host can add another layer to this variation.

Davis et al. (2016) demonstrated that rabies-infected silver-haired bats maintained under hibernation conditions had an extended incubation period compared with bats maintained at ambient temperature. This provided experimental evidence that overwintering conditions can delay the progression of rabies infection. Overwintering does not mean that every infected bat becomes permanently infected without disease or that rabies universally becomes dormant. The findings were obtained under specific experimental conditions and cannot be applied identically to every bat species or natural infection.

However, the study demonstrates an important principle: seasonal changes in host physiology can extend the interval between infection and disease.

When bats become active again, their behaviour and population dynamics also change. Increased movement and contact, together with seasonal reproduction, can create new opportunities for transmission. Consequently, infection carried through one season may become relevant again when the host population becomes active.

What Hibernating Bats Teach Us About Rabies Ecology?

At the population level, rabies persistence depends on more than viral replication. Host survival, reproduction, mortality, movement and the availability of susceptible animals all influence transmission. George et al. (2011) used mathematical modelling to investigate seasonal rabies dynamics in big brown bats (*Eptesicus fuscus*) in Colorado. Their model suggested that hibernation, prolonged incubation and seasonal reproduction could work together to support viral maintenance.

During winter, infected bats that survive and remain within the population may carry infection through a period of reduced activity. Later, seasonal reproduction introduces susceptible young bats into the population. When bats become active again, these changes can create opportunities for transmission. This means that continuous transmission throughout the year may not be necessary for a virus to persist in a seasonal host population. Survival of infected individuals across an unfavourable period can help bridge successive periods of transmission. Hibernation is therefore one component of a larger ecological system rather than a complete explanation for rabies persistence. Host species, population structure, reproduction, mortality, movement and transmission opportunities all contribute to the outcome.

The key lesson is that the biology of the host can influence the biology of the virus. In hibernating bats, seasonal changes in physiology may alter the timing of infection, while seasonal changes in population structure can influence when transmission becomes possible.

Conclusion:

Hibernation provides a striking example of how host physiology can shape viral infection. Experimental studies show that low-temperature conditions can reduce rabies virus multiplication and extend the incubation period in certain bats, while ecological modelling suggests that hibernation and seasonal reproduction may contribute to viral maintenance between transmission periods. The story of rabies in hibernating bats therefore extends beyond the virus itself. It demonstrates that viral persistence is closely connected to the biology, physiology and seasonal rhythm of its host. In this unusual host-virus relationship, time itself becomes an important part of rabies ecology.

References:

- Calisher CH, Childs JE, Field HE, Holmes KV, Schountz T. Bats: important reservoir hosts of emerging viruses. *Clinical Microbiology Reviews*. 2006;19(3):531–545. doi:10.1128/CMR.00017-06.
- Davis AD, Morgan SM, Dupuis M, Poulliott CE, Jarvis JA, Franchini R, Clobridge A, Rudd RJ. Overwintering of rabies virus in silver-haired bats (*Lasionycteris noctivagans*). *PLOS ONE*. 2016;11(5):e0155542. doi:10.1371/journal.pone.0155542.
- George DB, Webb CT, Farnsworth ML, O'Shea TJ, Bowen RA, Smith DL, Stanley TR, Ellison LE, Rupprecht CE. Host and viral ecology determine bat rabies seasonality and maintenance. *Proceedings of the National Academy of Sciences*. 2011;108(25):10208–10213. doi:10.1073/pnas.1010875108.
- Sulkin SE, Allen R, Sims R, Krutzsch PH, Kim C. Studies on the pathogenesis of rabies in insectivorous bats: II. Influence of environmental temperature. *Journal of Experimental Medicine*. 1960;112(4):595–617. doi:10.1084/jem.112.4.595.