

### American Robins as Reservoir Hosts for Lyme Disease Spirochetes

**To the Editor:** The article by Richter et al. (1) presents interesting results, not only on the ability of American robins to transmit Lyme disease spirochetes but also on the birds' tolerance to reinfection after the original infectivity has waned. Even more interestingly, spirochetes that had been transmitted by these avian hosts were then transmitted by laboratory mice. However, important research on wildlife hosts of the various genetic strains of Lyme spirochetes is not fully acknowledged. Therefore, the new results are not put into the context of existing information, missing the opportunity for much interesting comparison between the American N40 strain of *Borrelia burgdorferi* sensu stricto, the subject of this work, and European strains of this and other *Borrelia* genotypes.

Chipmunks (United States [2]), two species of squirrels (United Kingdom [3] and Switzerland [4]), and hedgehogs (5) are missing from the list of wildlife hosts, and the competence of sheep is denied despite evidence to the contrary (6). Moreover, European blackbirds, which have been shown to transmit spirochetes to xenodiagnostic larval ticks (7), are dismissed as transmission hosts on the basis of earlier negative transmission results from Matuschka (8), which came from two birds and pre-dated knowledge of the genetic diversity and apparent

host specificity of *B. burgdorferi* sensu lato. Pheasants are also dismissed as not contributing to transmission because, according to the authors, larval ticks do not feed on them. Although significantly fewer larvae than nymphs feed on wild pheasants, in the summer similar numbers of larvae feed on pheasants (median 7, range 0-64 on cock birds; median 0, range 0-7 on hens) as on rodents (3,9,10). Laboratory and field data (9,11) analyzed within a general transmission framework (10) suggest that pheasants can act as a natural reservoir for spirochetes of some genotypes.

A growing body of evidence, both observational and experimental, suggests that certain *B. burgdorferi* s.l. genotypes (e.g., *B. afzelii*) are transmitted much more efficiently by mammals and that other genotypes (e.g., western European *B. garinii*) are transmitted more efficiently by birds (4,7,11-14). Given the apparent lack of host specificity of *B. burgdorferi* s.s. N40, the new results would add to recent advances in explaining Lyme spirochete ecology if they were put in the context of these consistent independent findings. It is now understood that Lyme spirochetes circulate through populations of mixed species of hosts, each species making different contributions to the overall persistence of the pathogen because of their differential transmission competence and infestations by each tick stage (11,15). Larval and nymphal ticks quest at different heights (16), and this behavior changes in response to microclimate, resulting in differential attachment rates to various vertebrate species (17). In such a population of hosts, any one species can contribute a basic reproduction number ( $R_0$ ) of less than unity but still play an important role in maintaining enzootic cycles (10,18).

Finally, some aspects of Richter et al.'s experimental results need clarification. Was the laboratory colony of ticks screened regularly for infection? Given the very high transmission rates recorded in this study (86% transmission by robins and 97.5% by mice), reassurance that all infections were derived from the experimental procedure would be helpful. In addition, the tolerance of repeated tick feeding by robins is not as high as claimed; 82% of 32 nymphs at the third infestation is (not quite significantly) lower than 96% of 48 and 98% of 40 at the first two infestations (Yate's corrected  $\chi^2 = 5.5$ , 2df,  $0.1 > p > 0.05$ ). Recent evidence suggests that

repeated infestations of ticks on mice, even without obvious reduced feeding success, result in reduced transmission of spirochetes between mice and ticks (19).

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### References

1. Richter D, Spielman A, Komar N, Matuschka F-R. Competence of American robins as reservoirs for Lyme disease spirochetes. *Emerg Infect Dis* 2000;6:133-8.
2. Slajchert TL, Kitron UD, Jones CJ, Mannelli A. Role of the eastern chipmunk (*Tamias striatus*) in the epizootiology of Lyme borreliosis in northwestern Illinois, USA. *J Wild Dis* 1997;33:40-6.
3. Craine NG, Nuttall PA, Marriott AC, Randolph SE. Role of grey squirrels and pheasants in the transmission of *Borrelia burgdorferi* sensu lato, the Lyme disease spirochaete, in the U.K. *Folia Parasitol* 1997;44:155-60.
4. Humair P-F, Gern L. Relationship between *Borrelia burgdorferi* sensu lato species, red squirrels (*Sciurus vulgaris*) and *Ixodes ricinus* in enzootic areas in Switzerland. *Acta Trop* 1998;69:213-27.
5. Gern L, Rouvinez E, Toutoungi LN, Godfroid E. Transmission cycles of *Borrelia burgdorferi* sensu lato involving *Ixodes ricinus* and/or *I. hexagonus* ticks and the European hedgehog, *Erinaceus europaeus*, in suburban and urban areas in Switzerland. *Folia Parasitol* 1997;44:309-14.
6. Ogden NH, Randolph SE, Nuttall PA. Natural Lyme disease cycles maintained via sheep by co-feeding ticks. *Parasitology* 1997;115:591-9.
7. Humair P-F, Postic D, Wallich R, Gern L. An avian reservoir (*Turdus merula*) of the Lyme borreliosis spirochete. *Zentralbl Bakteriol* 1998;287:521-38.
8. Matuschka F-R, Spielman A. Loss of Lyme disease spirochetes from *Ixodes ricinus* ticks feeding on European blackbirds. *Exp Parasitol* 1992;74:151-8.
9. Kurtenbach K, Carey D, Hoodless AN, Nuttall PA, Randolph SE. Competence of pheasants as reservoirs for Lyme disease spirochetes. *J Med Entomol* 1998;35:77-81.
10. Randolph SE, Craine NG. General framework for comparative quantitative studies on transmission of tick-borne diseases using Lyme borreliosis in Europe as an example. *J Med Entomol* 1995;32:765-77.
11. Kurtenbach K, Peacey MF, Rijpkema SGT, Hoodless AN, Nuttall PA, Randolph SE. Differential transmission of the genospecies of *Borrelia burgdorferi* sensu lato by game birds and small rodents in England. *Appl Environ Microbiol* 1998;64:1169-74.
12. Humair P-F, Peter O, Wallich R, Gern L. Strain variation of Lyme disease spirochetes isolated from *Ixodes ricinus* ticks and rodents collected in two endemic areas in Switzerland. *J Med Entomol* 1995;32:433-8.
13. Hu CM, Humair P-F, Wallich R, Gern L. *Apodemus* sp. rodents, reservoir hosts for *Borrelia afzelii* in an endemic area in Switzerland. *Zentralbl Bakteriol* 1997;285:558-64.
14. Kurtenbach K, Sewell H, Ogden NH, Randolph SE, Nuttall PA. Serum complement sensitivity as a key factor in Lyme disease ecology. *Infect Immun* 1998;66:1248-51.
15. Humair P-F, Rais O, Gern L. Transmission of *Borrelia afzelii* from *Apodemus* mice and *Clethrionomys voles* to *Ixodes ricinus* ticks: differential transmission pattern and overwintering maintenance. *Parasitology* 1999;118:33-42.
16. Gigon F. Biologie d'*Ixodes ricinus* L. sur le Plateau Suisse—une contribution à l'écologie de ce vecteur [thesis]. Neuchâtel, Switzerland: l'Université de Neuchâtel: 1985.
17. Randolph SE, Storey K. Impact of microclimate on immature tick-rodent interactions (Acari: Ixodidae): implications for parasite transmission. *J Med Entomol* 1999;36:741-8.
18. Rogers DJ. A general model for the African trypanosomiases. *Parasitology* 1988;97:193-212.
19. Wikel SK, Ramachandra RN, Bergman DK, Burkot TR, Piesman J. Infestation with pathogen-free nymphs of the tick *Ixodes scapularis* induces host resistance to transmission of *Borrelia burgdorferi* by ticks. *Infect Immun* 1997;65:335-8.