

American Robins as Reservoir Hosts for Lyme Disease Spirochetes

To the Editor: We read with great interest the article by Richter et al. (1) reporting the competence of American robins as reservoir hosts for Lyme disease spirochetes. The article demonstrates that *Turdus migratorius* is a reservoir for *Borrelia burgdorferi* sensu lato under experimental conditions. However, we want to draw attention to certain statements in the article regarding current knowledge of the ecology of Lyme borreliosis in Europe.

First, in the discussion the statement "The standard of proof (implied xenodiagnosis)... has not previously been applied to candidate avian reservoirs" is inaccurate. In fact, this method was applied a few years ago to pheasants (*Phasianus colchicus*) in the United Kingdom (2) and to European blackbirds (*Turdus merula*) in Switzerland (3) to investigate their respective reservoir competence. Even though these articles were cited by Richter et al., the use of xenodiagnosis detailed in them was not mentioned.

A second statement in the introduction claims that "Although spirochetes have been isolated from naturally infected European blackbirds (*T. merula*) (Humair et al., 1998), a laboratory study failed to demonstrate reservoir competence of these birds (Matuschka and Spielman, 1992); the reason for this discrepancy remains unclear." However, the reservoir competence of European blackbirds has been clearly demonstrated by tick xenodiagnosis (3).

Another statement cited in the introduction that pheasants "...cannot contribute to transmission because larval ticks seem not to feed on them, either in the laboratory or in nature (Kurtenbach et al. 1998a, 1998b)" is incorrect; no such statement occurs in the two papers by Kurtenbach et al. (2,4). Moreover, Randolph and Craine have clearly demonstrated that pheasants contribute to *Borrelia* transmission to ticks (5).

Finally, in the statement "Although certain genospecies of the Lyme disease spirochetes are said to be more mouse-adapted than others (Humair et al. 1995), no experimental evidence is available to support this concept" the term concept is inappropriate. *B. afzelii* and *B. burgdorferi* have been found associated with both Muridae and Sciuridae in various ecologic

situations (4,6-10). *B. garinii* and *B. valaisiana* have been observed preferentially associated with certain avian hosts and associated ticks in particular ecologic situations (3,4,11-13). All these published results (3,4,6-13) demonstrate that the relationships between genospecies of *Borrelia* and hosts observed in some areas of Europe have gone beyond concept and are facts. Because the explanation of a phenomenon is not immediately obvious one cannot assert that the phenomenon does not exist or that the evidence can be denied. *Borrelia* sensitivity to serum complement may explain the existence of a preferential relationship between host and *Borrelia* genospecies (14).

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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