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Letter to the Editor
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Errata Abound in Human Babesiosis Communique: Retort to Kumar, O'Bryan and Krause

*John D. Scott**

Upper Grand Tick Centre, Fergus, Ontario, Canada

Letter to the Editor

Kumar et al. [1] hereafter called authors, indicate that *Babesia microti* is the main *Babesia* species in North America, but skip *Babesia odocoilei* as the predominant *Babesia* sp. continent-wide [2-6]. They speculate that babesiosis will merge between the Midwest and the East Coast, but sidestep the fact the *B. odocoilei* already fills this geographic gap [2-6]. In eastern and central North America, acarology research teams have reported *B. odocoilei*-infected vector ticks on avian and mammalian hosts and by flagging low-level vegetation [2-8]. One research team found that half of the *Babesia* spp. detected in adults of blacklegged ticks, *Ixodes scapularis*, in Maine harbored *B. microti*, whereas the other half were *B. odocoilei* [3]. Notably, the *Babesia* species detected in each of the other three states (i.e., Indiana, Pennsylvania, and Wisconsin) were *B. odocoilei.*

B. odocoilei, which is a human pathogen [9], was ignored. Even though *B. odocoilei* was approved by national and international biomedical ethics review boards, it was bypassed as a recognized human pathogen. In Canada, all of the four references cited are inappropriate, and are miscitations. The first citation was not conducted in Canada, and the second one was generated in Europe. The third citation had out-of-country travel. The fourth citation was a case report, and not a comprehensive biomedical human study with multiple subjects. The only fully validated, Canada-based human biomedical study (i.e., with typical human babesiosis symptoms, molecular identification, and approval by accredited national and international human biomedical ethics review boards) was omitted [9]. Furthermore, this study met the stringent criteria of the Tri-Council Policy Statement, namely Ethical Conduct for Research Involving Humans, Government of Canada and, likewise, an international, biomedical human ethics review board. Based on the quintessential findings of the Canadian human biomedical study [9], this authentic Canada-based study meets the highest requirements ethically, medically, and scientifically.

In the *Babesia venatorum* section (5.3), which discusses *B. odocoilei*, the Canada-based human study is once again ignored [9]. In contrast, the authors cite a *Babesia crassa*-like sp. study in northeast China nine times. Since the China study and the full-fledged Canadian study follow comparable algorithms, it is unclear why the authors favor the China study. The algorithms used in the Canada-based study supersede all other studies in the Review. Not only was PCR, DNA sequencing, Basic Local Alignment Search Tool (BLAST) analysis, and phylogenetic analysis employed, E-values confirmed *B. odocoilei* DNA in bloods of positive human babesiosis subjects [9].

Inconsistencies in reporting *Babesia* sp. as human babesiosis are apparent. On page 6, the authors state that *B. microti* can result in death, but later, on the same page, state that *B. microti* causes mild or asymptomatic infection—a contradiction. In the India section, a single case of human babesiosis was "confirmed" but, paradoxically, the *Babesia* sp. was not identified. *Babesia motasi* is listed as a *Babesia* sp. that causes human babesiosis; however, ironically, in the China section (6.2.6), the authors state that *B. motasi* has not been shown to cause human infection—another contradiction of fact. *Babesia odocoilei* went amiss in the list of six human pathogens.

The authors state that patients must live in or travel through an endemic area to acquire human babesiosis. The authors also state that songbirds transport *Babesia*-infected ticks long distances. These two sentences coupled together lack logic. Songbirds widely disperse *B. odocoilei*-infected *I. scapularis* randomly across the landscape to where people reside [4-7]. Frequenting an endemic area is not required to contract human babesiosis. The authors state that birds transport *I. scapularis* larvae over long distances, but bypassed the fact passerine birds typically transport *I. scapularis* nymphs [4-7].

The authors state that "birds can serve as hosts of *B. burgdorferi* but not *B. microti*;" this statement

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Correspondence:
John D. Scott, Upper Grand Tick Centre, 365 St. David Street South, Fergus, Ontario, N1M 2L7, Canada, E-mail: jkscott@bserv.com

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is devoid of references. The authors forget songbirds are important avian hosts — a discernible oversight. Contrary to assertions, mathematical modeling cannot predict where songbird migrants will transport *I. scapularis* nymphs infected with *B. microti* and/or *B. odocoilei.*

The authors assert that the emergence of human babesiosis is due to an increase in white-tailed deer, *Odocoileus virginianus,* but fail to provide a reference to substantiate this claim. In fact, these cervids are not known to harbor *B. microti.* White-tailed deer are reservoirs of *B. odocoilei* [10], and this *Babesia* sp. causes persistent and recrudescent human babesiosis [9]. Not only are deer reservoirs of *B. odocoilei,* they are hosts of *I. scapularis.* As ectoparasites, *I. scapularis* have a wide host spectrum including birds, lizards, and mammals, including humans [11,12]. In sothern Canada, guesting *I. scapularis* adults had a *B. odocoilei* prevalence of 20% [6], whereas the *B. microti* prevalence was 1.3% in northeast China and, likewise, in northeastern United States.

Citing Jia et al. [13], the authors erroneously state in two parts (6.2.3 and 6.2.6) of the "Babesiosis in Asia" section that *I. scapularis* are present in China when, in fact, the taiga tick, *Ixodes persulcatus*, is the actual indigenous vector — not *I. scapularis.* The authors also state that *I. scapularis* is the primary vector of *B. microti* in North America, but missed the fact that *B. odocoilei* is the foremost *Babesia* species [3-6]. Unlike *B. microti*, many piroplasmids (i.e., *B. odocoilei*) are capable of cytoadherence and sequestration, and produce chronic infections. In the Canada-based study, cross-reactivity between *B. odocoilei* and *B. duncani* was documented, but missed by the authors.

The authors opined that *I. scapularis* infected with *B. microti* have been found in six different localities in Manitoba; however, there was no seminal reference to substantiate this claim. The comment about expansion of human babesiosis due to climate change is ill-conceived, unsubstantiated, and inconclusive [14].

The authors have repeatedly used the word "antibiotics" throughout the text when, in fact, "anti-babesials,""antimicrobials," or "anti-*Babesia* therapy" are standard medical terms. The authors state that standard "antibiotics" (i.e., atovaquone and azithromycin or clindamycin and quinine) are usually very effective to treat human babesiosis. In contrast, several research teams have reported treatment failures with these anti-*Babesia* therapies [9,15-17].

Miscellaneous errors occur throughout the text, including typos, punctuation mistakes, and grammatical inaccuracies. For instance, "*Babesia* spp.," which is plural, was used when the single form, "*Babesia* sp.," was needed. Words are capitalized when they should not be capitalized (i.e., "Ixodid" should be "ixodid") [11]. Certain scientific terms are misspelled (i.e., "Demacentor [sic] albipictus") while others (i.e., "Ixodes," "Haemaphysalis") must be italicized. The authors used imperial measure (i.e., miles) instead of metric measure (i.e., kilometers). In science, metric measurement is required. Moreover, terminology is incorrect; "transstadial transmission" is used, but the precise term is "transstadial passage" [11]. Similarly, on the same line, the authors use tick terminology improperly; "mother" should be "gravid female." Mathematical calculations are incorrect. In section 6.2.2., "0.16%" should be "1.6%" and, in section 6.2.3, "5.0%" should be "5.2%." In section 6.2.6, ticks belong to acarology — not entomology. Contrary to contentions, *B. microti* does not undergo transovarial transmission [11].

In summary, multiple errors, subtle omissions, and troubling bias abound throughout the Review. There is no supportive information in the text to justify a vaccine in the Conclusions. Since the vast majority of *Babesia* spp. in the U.S.A. and Canada is *B. odocoilei*, the prevalence of *B. microti* has been highly overrated. In humans, *B. odocoilei* can cross-reacts with *B. duncani* [9]. The Review is not only misleading but lacks basic scientific principles.

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