

6. LYME DISEASE IN AUSTRALIA: DENIAL AND EVIDENCE

WITH THE BACKDROP OF THE AMERICAN SITUATION AND THE CHALLENGES faced there, one can see the context from which the experience of Lyme disease in Australia arises. But even more dire is the unsurprising fact that the health authorities still deny any existence of Lyme disease in Australia.

In spite of historical precedence and current evidence indicating otherwise, Australian health authorities continue to deny the possibility of locally acquired Lyme disease. They claim that only those who have travelled outside the country can contract Lyme since neither *Borrelia burgdorferi* nor the co-infections responsible for Lyme are found in Australian ticks.

As of the time of writing, the situation is still one of denial. The Fact Sheet on Lyme disease issued by the NSW Health Department¹ states:

“While locally acquired Lyme disease cannot be ruled out, there is little evidence that it occurs in Australia. There is a continuing risk of overseas-acquired Lyme disease being imported into NSW.”

These conclusions were reached by an “expert” panel in April 2011, composed of specialists in public health, epidemiology, infectious diseases, rickettsial diseases and entomology. So although officials do not completely rule out the acquisition of Lyme in Australia, they certainly seem loath to admit it occurs.

LYME DISEASE in Australia

The Fact Sheet also states:

“Only some species of ticks are capable of being infected by the *Borrelia* bacteria and only these infected ticks can pass the infection on to humans. This group of ticks is found in Asia, Europe and North America, but not in Australia.”

The fact sheet does agree, however, that ticks can transmit infections, and that “while there is little evidence that Lyme disease is caused by Australian ticks, there may be other infections carried by Australian ticks which may cause an infection which is similar to Lyme disease. These infections are poorly characterized.” That sounds conveniently vague, although it does imply that the Australian authorities are actually aware of a Lyme-like syndrome that *does* occur in Australia.

The NSW Government statement also discusses testing. While it does recognize that the diagnosis of Lyme is based on symptoms, physical findings and the possibility of exposure to infected ticks (rather than strictly on laboratory findings), it goes on to say that lab tests are rarely definitive (which I agree with), and that when testing is done in places where disease is rare or absent (“for example”, their website states, “Lyme disease in Australia”), many positive test results will be false positives. This indicates to me that the government is not even open to being proven wrong. Even if an individual has a positive lab test for Lyme, it may be written off as a false positive. Further, Lyme disease is not reportable in NSW, so the health departments do not gather data on the incidence and growth rates of Lyme disease. Why should we believe that positive test results are false positives just because the Health Department does not like to think of Lyme disease as an Australian problem? This position is highly illogical.

Much of the denial of Lyme disease in Australia comes from a study by Russell and Doggett published in 1994.²

Russell and Doggett were given a National Health and Medical Research Council (NHMRC) grant to investigate whether Australian ticks carry the *Borrelia* bacteria. Although they reported that they were unable to isolate any *Borrelia* DNA from the 12,000 common Australian ticks

collected from the Eastern seaboard, there are great limitations to that study. First, only 1,038 of those 12,000 ticks were tested by PCR (a very specific kind of testing). Second, during the study, Russell and Doggett assumed that only the *B. burgdorferi* strain could cause Lyme disease, and only tested the ticks for these strains. Studies in Europe, which had identified at least two other strains (*B. garinii* and *B. afzelii*) as causative factors in Borreliosis, were not acknowledged. Third, they used both fed and unfed ticks. Unfed ticks that have not had a blood meal are far less likely to contain spirochetes and other infectious agents than those that are full of blood.

Ironically, they did isolate “spirochete-like objects” in the fed ticks, but decided that they were artefacts (bacteria-like objects under the microscope but not actual bacteria) and did not include them as significant findings. In summary, the study concluded that ticks in Australia did not carry spirochetal bacteria.

Slightly misleading and somewhat confusing in the light of Russell and Doggett’s published results is an article by James Alpers.³ In this article, Alpers claims that Doggett *had* made over 70 isolates of spirochete-like organisms from more than 30 separate coastal areas stretching from Southern Queensland to northern Victoria. Richard Russell, one of the primary authors on the “there are no spirochetes in Australian ticks” study is quoted in this article:

“A number of different tick species have been found to harbour the [spirochete-like] organisms, although *Ixodes holocyclus*, the ‘paralysis tick’, has yielded more isolates than other species. We are undertaking various investigations, including molecular studies, to characterize our isolates, and if the organisms being recovered from ticks are responsible for the human infection, then the widespread origin of our many isolates indicates the disease may be quite extensive on the coast of south-east Australia.”

Just two years later, Russell and Doggett published research stating that the aforementioned isolates were simply “artefact”, and not spirochetal

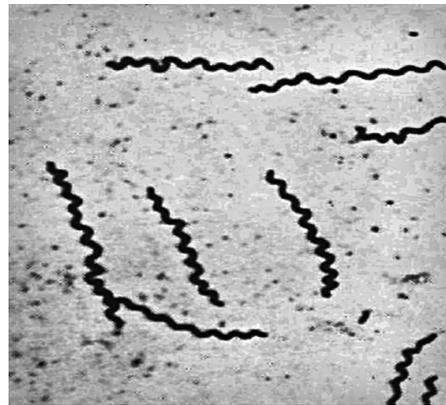
LYME DISEASE in Australia

bacteria with potential clinical significance. And from that time the widespread denial of Lyme disease in Australia was solidified.

Before we take that one study and use it to deny an emerging health crisis, let us take a look at some of the other evidence. Even prior to that Russell and Doggett study, *Borrelia* had already been identified in Australia.

A publication by Carley and Pope⁴ identified an Australian strain of *Borrelia*, which they named *Borrelia queenslandica*. They described this strain of *Borrelia* being isolated from wild rats called *Rattus villosissimus*. These rats flourish during plagues, this one centered in Queensland. When the rats died off in large numbers, an assessment of infectious agents causing the eradicating was done and three agents were found – *Streptobacillus moniliformis*, *Hemobartonella muris* and a spirochete with the characteristics of *Borrelia*. These characteristics, according to Carley and Pope, matched in morphology, size, restricted host range, type of infection and sensitivity to antibiotics, to *Borrelia* spirochetes described in other research. Antibiotics found to be effective in this mouse study included penicillin, a tetracycline (chlortetracycline), streptomycin and chloramphenicol.

The authors cited ticks of the genus *Ornithodoros*, in particular *Ornithodoros gurneyi* in inland Australia including northwestern Queensland, as significant vectors. They named the spirochetes *Borrelia queenslandica* because of the location of the rat plague that housed them.



***Borrelia queenslandica* spirochetes as detected by Carley and Pope in 1962**

Mackerras (1959) also reported the isolation of *Borrelia* from Australian fauna including kangaroos, wallabies and bandicoots.⁵

Of course, Russell and Doggett (1994) did not acknowledge either of these two publications in their study.

Case reports of Lyme disease in Australia date back to the early 1980's. Three of them are reported in case reports and letters to the editor in the Medical Journal of Australia. All three meet the diagnostic criteria for Lyme disease.

In 1982, Stewart et al. described the case of a 21-year-old labourer from Branxton near the lower Hunter Valley.⁶ His bite occurred in 1980, and gave rise to a red rash that spread outwards from a lump at the site of the bite, with a central clearing in the middle. The authors described it as a lesion typical of ECM (erythema chronicum migrans).

The authors stated: "This patient's clinical course presented the classical features of Lyme arthritis", which meant it was migratory, moving from joint to joint, and relapsing, coming and going. But there were two other complicating factors indicative of Lyme disease - cognitive deficits including behavioural change and memory loss; and also tachycardia (rapid heart rate).

Between the EM rash, the arthritis, the cardiovascular symptoms and neurological issues, the authors describe this patient's presentation as part of the "classic syndrome" of Lyme disease. They also mentioned that there had been six cases of EM rash diagnosed by Hunter Valley dermatologists over the prior 12 months (1981-82), "which indicates that the etiologic agent (the Ixodes tick) is well established in that area".

Another notable case report was in 1986.⁷ This one was on the south coast of New South Wales (NSW), in Guerilla Bay near Moruya. A 34-year-old gardener reported to his doctor in March 1985 after insect bites on his arm and back. He had a red rash that spread out from the site of the bite, which was assessed as an EM rash. He was given antibiotics and the rash resolved only to reappear at a later date and require a second course of antibiotics.

Another, 60-year-old female patient from Bendalong, between Nowra and Ulladulla, NSW, presented with headaches, fatigue and joint pain that were associated with a rash on her chest wall and left thigh that the

LYME DISEASE in Australia

author reported to be consistent with an EM rash.⁷ She was diagnosed with early Lyme disease and treated with doxycycline. The rash and symptoms resolved and at the time the case was written up the lady had continued to be well. That was in December 1985.

In 1986, yet another case report from the Central Coast of NSW appeared in the *Medical Journal of Australia*.⁸ This case was a 70-year-old Sydney resident who had spent time in Gorokan on the Central Coast in December 1985. While there was no recollection of a tick bite, the patient had spent time cutting brush. In January 1986 he developed lethargy, malaise, fevers and night sweats. A few weeks later several round rashes appeared on his body, up to 5cm in diameter with central clearings, along with severe occipital headaches, a sore throat and high fevers. The rashes were consistent with the EM rashes of Lyme disease, and he was assessed as having early, uncomplicated Lyme disease based on clinical criteria and treated accordingly.

Going back now to studies looking for *Borrelia* in ticks - in the early to mid 1990's, at around the same time as Russell and Doggett were publishing their research claiming that no spirochetes had been identified in Australian ticks, another group at the University of Newcastle and Royal North Shore Hospital in Sydney (Professors Richard Barry, Michelle Wills and Bernie Hudson) was investigating the same question. In contrast to Russell and Doggett, Michelle Wills did isolate and grow the spirochetes from Australian ticks, and identified the spirochetes as *Borrelia*.

The starting point for the study, as she described in her letter to the editor published in the *Medical Journal of Australia*, was the notion that Australian Lyme disease is caused by a spirochete similar, but not necessarily closely related antigenically, to *B. burgdorferi*, and that the spirochete cycles through native fauna and domestic animals, transmitted by a tick with a wide range of hosts.

Wills et al. cultured the gut contents of a large number of ticks. 70 of 167 (42%) were culture-positive for *Borrelia*-like spirochetes. These spirochetes were described as indistinguishable from the reference strain

of *B. burgdorferi*, being large, coiled, motile bacteria with an irregular rotational movement. In other words, the spirochetes they found in Australian ticks could not be differentiated from the *B. burgdorferi* they were comparing them to.

In a letter to the editor published in the Medical Journal of Australia in 1991, Michelle Wills B.Sc. concluded:

“These findings indicate that some species of tick often responsible for human and animal tick bites in this country commonly harbour *Borrelia* species spirochetes. On structural and antigenic grounds these microbes are likely to be the aetiological agents of Lyme disease in Australia.”⁹

That was in 1991. Imagine how the situation today could be different if the Australian government had accepted and acted on the results of this study and not the Russell and Doggett study.

In the early 90's groups from the Royal North Shore (including Hudson) and Newcastle University (including Wills) joined forces to “define the incidence and prevalence of Lyme Borreliosis in Australia, develop screening and confirmatory laboratory tests for the disease, and to educate the medical community about Lyme disease”. They had suspected that Lyme disease was more common than had been currently recognized, with an increasing number of suspected cases from the hospital's catchment area in recent years. This had actually led to the creation of a phone line where people could call in if they had suspected Lyme disease, so that they could collect samples for study. At that time Bernard Hudson, M.D. is quoted as saying “there is no doubt that Lyme disease is around on the south coast and the northern beaches of Sydney. Numerous suspected cases have come to my attention through clinicians in these areas. Now we just have to find out how common the disease actually is.”

In 1994 these researchers (including Michelle Wills of the 1991 study, and Bernie Hudson M.D. of the Department of Microbiology at Royal North Shore Hospital in Sydney), published in the Journal of Spirochetal and Tick-Borne Diseases.

LYME DISEASE in Australia

They proposed the existence of an indigenous form of Lyme disease in Australia based on the data they had collected since 1991. They describe the clinical presentations of erythema migrans rash arthritis and radiculopathy in candidate Lyme Borreliosis cases in Australia. When they tested the blood of these candidate patients, they discovered antibodies to European strains of *Borrelia* - *Borrelia garinii* and *Borrelia afzelii*, while antibodies to *Borrelia burgdorferi* were uncommon.

1,024 people were tested and approximately 20% tested positive on a Western Blot against the American strain *B. burgdorferi*, the European strain *B. garinii*, or *B. afzelii*. 56% of the positive results were due to *B. garinii*, 34% to *B. afzelii* and only 10% to *B. burgdorferi* (Wills, PhD, 1995).

Russell and Doggett only tested for *Borrelia burgdorferi*, not the European strains *garinii* and *afzelii*. From that research the authorities denied the existence of *any* *Borrelia* causing disease in Australia. Yet evidence seems clear that strains of *Borrelia* do exist – they are just more closely related to the European variants *B. garinii* and *B. afzelii*. This is a major disconnect in the available research and the significance of this is profound for the recognition of Lyme disease today.

This team of researchers and clinicians seem to have no doubt that Lyme disease exists in Australia; in fact, the publication clearly states: “One of us (Bernie J Hudson) regularly sees clinical cases of Lyme Borreliosis acquired in Australia.”

The Medical Journal of Australia article goes on to discuss the case definitions of Lyme disease. It recognizes that the initial case definition in Australia has been based on the United States CDC criteria, which the authors admit to be problematic. Part of the reason they find the use of the U.S. case definitions problematic is that the clinical manifestations of Borreliosis are so different with different species of *Borreliae* from different parts of the world. If Australian patients are more likely to be infected with European strains, which the research certainly suggests, they are not necessarily going to present with manifestations that the United States CDC has deemed characteristic of Lyme disease. They

also discuss limitations of testing, and that they have chosen to use the Western Blot over either an IFA or ELISA method of testing, because of lack of sensitivity of the latter tests.

They also offer that the European strains should be used in immunoblotting as part of their testing methodology and not the American strains, to get more accurate results. "Recombinant proteins from well-characterized North American strains may be of little use for immunoblotting [Western Blotting] in Australian LB cases." In simple terms, this means that using European strains as part of the testing methodology instead of American strains will yield more accurate results.

Dr. Hudson collated a group of 23 patients with an assumption of Lyme Borreliosis (LB) based on clinical presentation. Of them 21/23 (>90%) had Flagellin antibodies while 13/23 (55%) had antibodies to OspA (these are antigens - the different parts of the spirochete that trigger immune reactions). The control group that was clinically assessed to have a diagnosis other than Lyme Borreliosis did not manifest the same antibodies to those antigenic markers. Thus it seems that the patients who appeared to have the symptoms of Lyme disease had a high chance of finding laboratory evidence of it, *once the European strains were used*.

A telling statement in this 1995 study was that "all patients acquired their illness in Australia". But wait, I thought Lyme disease does not exist in Australia?

To summarize, Hudson et al. state:

"Because we have detected *Borrelia*-specific antibodies in the serum of candidate clinical cases of LB acquired in Australia, we hypothesize that an indigenous form of Lyme Borreliosis exists in Australia. The acquisition of at least one case outside the area of distribution of *I. holocyclus* indicates that ticks other than this species can transmit LB in Australia."

In 1998 Hudson et al. appeared again in the Medical Journal of Australia¹⁰, this time with a case report of Lyme Borreliosis with a positive skin

LYME DISEASE in Australia

biopsy for *Borrelia garinii*. Although the patient had traveled to Europe 17 months prior to onset of his illness, the authors stated it was more likely that the infection was acquired in Australia based on the clinical details of the case.

They deduced this for a number of reasons. Firstly the patient had no awareness of a tick bite or tick exposure during his trip to Europe; he was there only for a few days. He did not become unwell immediately after his European trip, or in the following seventeen months. He did however have a tick bite while walking in bushland in Pittwater Shire in Sydney. Sixteen days after the bite a characteristic EM rash developed; his illness commenced within a few days of the bite, starting with headache, malaise and a low-grade fever, progressing over time to include cognitive deficits, a fullness in the head, and muscle and joint pain.

What is so significant about this case is that *Borrelia garinii* was cultured from this patient's skin, with infection emerging after a tick bite in the Sydney region. While *B. garinii* is more concentrated in European countries, the authors concluded that the migratory patterns of birds from the Northern Hemisphere explains their introduction into Australia. Certainly positive polymerase chain reaction (PCR) data exist to show the presence of *B. garinii* in ticks in the Southern Hemisphere.¹¹ Unfortunately, the fact that the patient had traveled to Europe 17 months prior to onset of illness, even though he denied a tick bite or tick exposure while there, and that he was well after that trip until his Australian bite, has been used to discredit the case report and raise questions as to whether his illness might have been acquired overseas.

Given that Mackerras (1959), Carley and Pope (1962) and Wills and Barry (1994) all managed to grow and isolate *Borrelia* from Australian native animals but only one study has been show to the contrary; and that researchers such as Hudson et al. (1995) and Wills (1991) have described clinical presentations of Lyme disease *and* found definitive laboratory evidence to support that, it follows that perhaps the findings of Russell and Doggett should be a side note rather than the source of a national denial of a major, and growing, health crisis.

What does become clear from an examination of the research is the major limitation of testing only for *Borrelia burgdorferi*, and not the European strains *garrinii* and *afzelii*. This single factor made all the difference in the outcome of the Russell and Doggett study, and may well have made all the difference in the recognition of Lyme disease in Australia to the present day.

Hudson et al. in their 1995 publication even offer that if the northern European experience is anything to go on, it is probable that there will be a delay in Australia between the recognition of indigenous Lyme Borreliosis and the isolation and identification of causative spirochetes. However, not yet having identified the exact morphology and behaviour of these particular spirochetes is a very different situation than simply not looking for them at all and flatly denying the possibility of their existence in this country.

Laurie Cestnick, from the School of Behavioural Sciences at Macquarie University, NSW, in the Australian and New Zealand Journal of Public Health 1998, gives a good synopsis:¹²

“Some people in Australia still hold the view that Lyme disease does not exist in Australia, partially because the symptoms of people infected here have been found to be slightly different to the symptoms of those infected in North America, where the spirochete, *Borrelia burgdorferi*, was first discovered; and also because serological evidence has been inconclusive.

In European countries and Australia, there have been central nervous system (CNS) complaints of sharp, shooting pains and migraines in the absence of any rashes or arthritic pain, whereas in North America there are more peripheral arthritic complaints than direct CNS complaints, although people with both sets of complaints do exist in these areas of the world.

Denial of the existence of Lyme in Australia based on different symptoms of patients here versus in America is not justifiable and may be hazardous from a treatment perspective.

LYME DISEASE in Australia

The causative agent of Lyme, the spirochete *B. burgdorferi*, has been detected in the cerebrospinal fluid of many persons with the symptoms of Lyme. In most cases, however, symptoms of Lyme exist in the absence of positive *Borrelia* serology.

Lyme researchers in Australia are of the strong opinion that the spirochete exists here, but behaviours of the spirochete and our immune systems make it difficult to detect serologically ... treatment decisions must be made based on the symptomatology of the patients and exposure to endemic areas for Lyme disease as opposed to positive serology.

In summary, given exposure to a tick, particularly in a proposed endemic area, and even one symptom of Lyme, the logical decision appears to be to offer treatment and ask more detailed questions later."

REFERENCES

1. Fact sheet: Lyme disease [Internet]. North Sydney (NSW): NSW Ministry of Health (Aus); [updated 2012 May 26; cited 2012 Jun 26]. [About 4 screens]. Available from: http://www.health.nsw.gov.au/factsheets/infectious/lyme_disease.html
2. Russell RC, Doggett SL, Munro R, Ellis J, Avery D, Hunt C, Dickeson D. Lyme disease: a search for a causative agent in ticks in south-eastern Australia. *Epidemiol Infect.* 1994 Apr;112(2):375-84.
3. Alpers J. *Borrelia* isolated from Australian ticks. *Today's Life Science.* 1992 Apr:40-2.
4. Carlye JG, Pope JH. A new species of *Borrelia* (*B. Queenslandica*) from *Rattus villosissimus* in Queensland. *Aust J Exp Biol Med Sci.* 1962 Aug;40:255-61⁵ Mackerras MJ. The haematzoa of Australian mammals. *Aust J Zool.* 1959;7(2):105-135.
5. Stewart A, Glass J, Patel A, Watts G, Cripps A, Clancy R. Lyme arthritis in the Hunter Valley. *Med J of Aust.* 1982;1:139
6. McCrossin I. Lyme disease on the NSW south coast. *Med J of Aust.* [Letter]. 1986 Jun 23;144.
7. Lawrence RH, Bradbury R, Cullen JS. Lyme disease in the NSW central coast. [Letter]. 1986 Oct 6;145:364.
8. Wills MC, Barry RD. Detecting the cause of Lyme disease in Australia. *Med J of Aust.* [Letter]. 1991 Aug 19;155:275.
9. Hudson B, Stewart M, Lennox V, Fukunaga M, Yabuki M, Macorison H, Kitchener-Smith J. Culture-positive Lyme Borreliosis. *Med J of Aust.* 1998 May 18;168:502.
10. Olsen B, Duffy CD, Jaenson TG, et al. Transhemispheric exchange of Lyme disease spirochetes by seabirds. *J Clin. Microbiol.* 1995 Dec;33(12):3270-74.
11. Cestnick L. Lyme disease in Australia. *Aust N Z J Public Health.* 1998;22(5):524.