

Persistence of Lyme Disease

The following references for persistence of Lyme disease (Lyme borreliosis) are listed alphabetically and chronologically:

1. Aalto A, Sjowall J, Davidsson L, Forsberg P, Smedby O. Brain magnetic resonance imaging does not contribute to the diagnosis of chronic neuroborreliosis. *Acta Radiol* 2007; 48: 755-762. [white matter hyperintensities or basal ganglia lesions].
2. Abele DC and Anders KH. The many faces and phases of borreliosis. *J Am Acad Dermatol* 1990; 23:401-410. [chronic Lyme borreliosis].
3. Aberer E and Klade H. Cutaneous manifestations of Lyme borreliosis. *Infection* 1991; 19: 284-286. [chronic Lyme borreliosis].
4. Aberer E, Breier F, Stanek G, and Schmidt B. Success and failure in the treatment of acrodermatitis chronica atrophicans skin rash. *Infection* 1996; 24: 85-87.
5. Aberer E, Kersten A, Klade H, Poitschek C, Jurecka W. Heterogeneity of *Borrelia burgdorferi* in the skin. *Am J Dermatopathol* 1996; 18(6): 571-519.
6. Akin E, McHugh GI, Flavell RA, Fikrig E, Steere AC. The immunoglobulin (IgG) antibody response to OspA and OspB correlates with severe and prolonged Lyme arthritis and the IgG response to P35 with mild and brief arthritis. *Infect Immun* 1999; 67: 173-181.
7. Albert S, Schulze J, Riegel H, Brade V. Lyme arthritis in a 12-year-old patient after a latency period of 5 years. *Infection* 1999; 27(4-5): 286-288.
8. Al-Robaiy S, Dihazi H, Kacza J, et al. Metamorphosis of *Borrelia burgdorferi* organisms—RNA, lipid and protein composition in context with the spirochete's shape. *J Basic Microbiol* 2010, 50 Suppl 1, S5-17.
9. Appel MJG, Allan S, Jacobson RH, Lauderdale TL, Chang YF, Shin SJ, Thomford JW, Todhunter RJ, and Summers BA. Experimental Lyme disease in dogs produces arthritis and persistent infection. *J Inf Dis* 1993; 167: 651-664.
10. Åsbrink E, Hovmark A. Successful cultivation of spirochetes from skin lesions of patients with erythema chronicum migrans, Afzelius and acrodermatitis chronica atrophicans. *Acta Pathol Microbiol Immunol Sect B* 1985; 93: 161-163.
11. Åsbrink E, Hovmark A, and Olsson I. Clinical manifestations of acrodermatitis chronica atrophicans in 50 Swedish patients. *Zentralbl Bakteriol Mikrobiol Hyg A* 1986; 26: 253-261. [chronic Lyme borreliosis].
12. Asch ES, Bujak DI, Weiss M, Peterson MGE, and Weinstein A. Lyme Disease: an infectious and postinfectious syndrome. *J Rheumatol* 1994; 21 (3): 451-461.
13. Bankhead T and Chaconas G. The role of VlsE antigenic variation in the Lyme disease spirochete: persistence through a mechanism that differs from other pathogens. *Molecular Microbiology* 2007; 65: 1547-1558.
14. Barthold SW, Persing DH, Armstrong AL, and Peeples RA. Kinetics of *Borrelia burgdorferi* dissemination and evolution of disease following intradermal inoculation of mice. *Am J Pathol* 1991; 139: 263-273. [in mice]
15. Barthold SW, deSouza MS, Janotka JL, Smith AL, and Persing DH. Chronic Lyme borreliosis in laboratory mouse. *Am J Pathol* 1993; 143: 951-971. [in mice]
16. Barthold S. Lyme Borreliosis. Chapter 14, *In Persistent Bacterial Infections*. Edited by J.P. Nataro, M.J. Blaser, and S. Cunningham-Rundles, pp 281-304. ASM Press, Washington, D.C.
17. Barthold SW, Hodzic E, Imai DM, Feng S, Yang X, and Luft BJ. Ineffectiveness of tigecycline against persistent *Borrelia burgdorferi*. *Antimicrob Agents Chemother* 2010; 54(2): 643-651. [Persistence is listed for many reservoir-competent hosts: mice, rats, *Peromyscus leucopus*, hamsters, gerbils, rabbits, dogs, nonhuman primates, and humans]
18. Battafarano DF, Combs JA, Enzenauer RJ, Fitzpatrick JE. Chronic septic arthritis caused by *Borrelia burgdorferi*. *Clin Orthop* 1993; 297: 238-241. [Patients with chronic septic Lyme arthritis of the

- knee for seven years, despite multiple antibiotic trials and synovectomies. Bb documented in synovium and synovial fluid.]
19. Bayer ME, Zhang L, Bayer MH. *Borrelia burgdorferi* DNA in the urine of treated patients with chronic Lyme disease symptoms. A PCR study of 97 cases. *Infection* 1996; 24: 347-353. [97 patients who had been treated with antibiotics for extended periods of time and had symptoms of chronic Lyme were PCR-positive.]
 20. Benjamin J and J Luft. Chronic Lyme disease; an evolving syndrome. 9th Annual International Scientific Conference on Lyme Disease & Other Tick-Borne Disorders. 1996.
 21. Berglund J, Stjernberg L, Ornstein K, Tykesson-Joelsson K, Walter H. 5-y follow-up study of patients with neuroborreliosis. *Scand. J. Infect. Dis.* 2002; 34(6): 421-425.
 22. Bloom BJ, Wyckoff PM, Meissner HC, and Steere AC. Neurocognitive abnormalities in children after classic manifestations of Lyme disease. *Pediatric Infect. Dis. J.* 1998; 17(3): 189-196.
 23. Bradley JF, Johnson RC, Goodman JL. The persistence of spirochetal nucleic acids in active Lyme arthritis. *Ann Intern Med* 1994; 120: 487.
 24. Bransfield R, Brand S, and Sherr V. Treatment of patients with persistent symptoms and a history of Lyme disease. *N Engl Med* 2001; 345: 1424-5.
 25. Breier F, Khanakah G, Stanek G, Aberer E, Schmidt B, and Tappeiner G. Isolation and polymerase chain reaction typing of *Borrelia afzelii* from a skin lesion in a seronegative patient with generalized ulcerating bullous lichen sclerosus et atrophicus. *Br J Dermatol* 2001; 144: 387-392. [*Borrelia afzelii*, ulcerating lichen sclerosus et atrophicus]. [Despite treatment with four courses of ceftriaxone, “[s]pirochetes were isolated from skin cultures obtained from enlarging LSA lesion...[S]erology ...was repeatedly negative.]
 26. Bockenstedt LK, J Mao, E Hodzic, SW Barthold, and D Fish. Detection of attenuated, noninfectious spirochetes in *Borrelia burgdorferi*-infected mice after antibiotic treatment. *J Infect Dis* 2002; 186: 1430-1437. [in mice]
 27. Brorson O and Brorson S-H. Transformation of cystic forms of *Borrelia burgdorferi* to normal mobile spirochetes. *Infection.* 1997; 25: 240-246. [change in physical characteristics; change of spirochetes to other pleomorphic forms, i.e., cell wall deficient forms, namely cysts.]
 28. Brorson O and Brorson S. *In vitro* conversion of *Borrelia burgdorferi* to cystic forms in spinal fluid, and transformation to mobile spirochetes by incubation in BSK-H medium. *Infection.* 1998; 26: 144-150. [change in physical characteristics; change of spirochetes to other pleomorphic forms, i.e., cell wall deficient forms, namely cysts.]
 29. Brorson O and Brorson S-H. An *in vitro* study of the susceptibility of mobile and cystic forms of *Borrelia burgdorferi* to tinidazole. *International Microbiol* 2004; 7: 139-142.
 30. Brown JP, Zachary JF, Teuscher C, Weis JJ, and Wooten M. Dual role of interleukin-10 in murine Lyme disease: regulation of arthritis severity and host defense. *Infect Immun* 1999; 67: 5142-5150. [suppression of harmful immune responses: defense stratagem of *B. burgdorferi*]
 31. Burrascano J. Failure of aggressive antibiotic therapy to protect the placenta from invasion by *B. burgdorferi* in a pregnant patient with Lyme borreliosis. 6th Annual International Science Conference on Lyme Disease and other Tick-borne Diseases. 1993.
 32. Cabello FC, Godfrey HP, and Newman SA. Hidden in plain sight: *Borrelia burgdorferi* and the extracellular matrix. *Trends in Microbiology* 2007; 15: 350-354. [sequestration]
 33. Cadavid D, O'Neill T, Schaefer H, and Pachner AR. Localization of *Borrelia burgdorferi* in the nervous system and organs in a nonhuman primate model of Lyme disease. *Lab Invest* 2000; 80: 1043-1054.
 34. Cadavid D, Y Bai, E Hodzic, K Narayan, SW Barthold, and Pachner AR. Cardiac involvement in non-human primates infected with the Lyme disease spirochete *Borrelia burgdorferi*. *Lab Invest* 2004; 84: 1439-1450. [in monkeys]
 35. Cameron D, Gaito A, Harris N et al. Evidence-based guidelines for the management of Lyme disease. *Expert Rev Anti-Infect. Ther* 2004; 2 (Suppl. 1), S1-S13.

36. Cameron D. Results from Lyme disease treatment trial. Columbia University/LDA Conference, Lyme & Other Tick-Borne Diseases: Emerging Tick-Borne Diseases. October 28, 2005; Philadelphia, Pennsylvania.
37. Cameron DJ. Generalizability in two clinic trials of Lyme disease. *Perspectives and Innovation* 2006; 3(12). [<http://dx.doi.org/10.1186/1742-5573-3-12>].
38. Cameron D. Severity of Lyme disease with persistent symptoms. Insights from a double-blind placebo-controlled clinical trial. *Minerva Med* 2008; 99: 489-496.
39. Cameron DJ. Insufficient evidence to deny antibiotic treatment to chronic Lyme disease patients. *Med Hypotheses* (2009), doi:10.1016/j.mehy.2009.01.017
40. Cameron DJ. Proof that Lyme disease exists. 2010. [<http://www.hindawi.com/60587146.html>].
41. Cameron DJ. Proof that chronic Lyme disease exists. *Interdisciplinary Perspect Infect Dis* 2010. doi:10.1155/2010/876450.
42. Cimmino MA, Azzolini A, Tobia F, Pesce CM. Spirochetes in the spleen of a patient with chronic Lyme disease. *Am J Clin Pathol* 1989; 91(1): 95-97.
43. Chary-Valckenaere I, Jaulhac B, Champigneulle J, Piement Y, Mainard D, and Pourel J. Ultrastructural demonstration of intracellular localization of *Borrelia burgdorferi* in Lyme arthritis. *Br J Rheumatol* 1998; 37: 468-470.
44. Chmielewski T, Tylewska-Wierzhanowska S. Inhibition of fibroblast apoptosis by *Borrelia afzelii*, *Coxiella burnetii* and *Bartonella henselae*. *Poll Microbiol* 2011; 60(3); 269-272.
45. Clarke AE, Esdaile JM, Bloch DA, Lacaille D, Danoff, and Fries JF. A Canadian study of the total medical costs for patients with systemic lupus erythema and the predictors of costs. *Arthrit. Rheum.* 1993; 36(11): 1548-1593.
46. Cleveland CP, Dennler PS, Duray PH. Recurrence of Lyme disease presenting as a chest wall mass: *Borrelia burgdorferi* was present despite five months of IV ceftriaxone 2 g, and three months of oral cefixime 400 mg BID. The presence of *Borrelia burgdorferi* confirmed by biopsy and culture. Poster presentation at V Lyme Disease Foundation International Scientific Conference. Stamford, CT, April 10-11, 1992.
47. Cleveland CP, and Dennler S. Case history: recurrence of Lyme disease as a chest wall mass. Abstract presented at the 1993 LDF International Conference on Lyme Disease.
48. Coyle P. Lyme Disease. Mosby Year Book, pp. 235, 1993. St Louis, Mo. [seclusion into immune privileged sites: defense strategem of *B. burgdorferi*]
49. Dattwyler RJ, Volkman DJ, Luft BJ, Halperin JJ, Thomas J, and Golightly MG. Seronegative Lyme disease. Dissociation of specific T- and B-lymphocyte response to *Borrelia burgdorferi*. *N Engl J Med* 1988; 319(22): 1441-1446.
50. Dejmková H, D Hulinska, D Tegzová, K Pavelka, J Gatterová, and P Vavřík. Seronegative Lyme arthritis caused by *Borrelia garinii*. *Clin Rheumatol* 2002; 21:330-334.
51. DeLong AK, Blossom B, Maloney E, and Phillips SE. Antibiotic retreatment of Lyme disease in patients with persistent symptoms: A biostatistical review of randomized, placebo-controlled, clinical trials. *Contemp Clin Trials* 2012; epub ahead of print. <http://dx.doi.org/10.1016/j.cct.2012.08.009>. [refutes Klempers {2001} conjecture that long-term antibiotics don't work]
52. de Koning J, et al. Demonstration of spirochetes in cardiac biopsies of patients with Lyme disease. *J. Infect. Dis.* 1989; 160: 150-153. [intracellular sanctuaries of Bb]
53. Demaerschalck I, Messaoud AB, de Kesel M, Hoyois B, Lobet Y, Hoet P, Bigaignon G, Bollen A, and Godfroid E. Simultaneous presence of different *Borrelia burgdorferi* genospecies in biological fluids of Lyme disease patients. *J Clin Microbiol* 1995; 33; 602-608.
54. Diringner MN, Halperin JJ, and Dattwyler RJ. Lyme meningoencephalitis—report of a severe, penicillin resistant case. *Arthritis Rheum* 1987; 30: 705-708.
55. Diterich I, Rauter C, Kirschning CJ, and Hartung T. *Borrelia burgdorferi*-induced tolerance as a model of persistence via immunosuppression. *Infect Immun* 2003; 71(7):3979-3987.
56. Donta ST. Tetracycline therapy for chronic Lyme disease. *Clin Inf Dis* 1997; 25 (Suppl 1);S52-56.

57. Donta ST. The existence of chronic Lyme disease. *Curr Treat Op Infect Dis* 2001; 3: 261-262.
58. Donta ST. Late and chronic Lyme disease. *Med Clin North Am* 2002; 86: 341-349.
59. Donta ST. Macrolide therapy of chronic Lyme disease. *Med Sci Monit* 2003; 9: 136-142.
60. Dorward DW, Fischer ER, and Brooks DM. Invasion and cytopathic killing of human lymphocytes by spirochetes causing Lyme disease. *Clin. Infect. Dis.* 1997. 25 Suppl 1: S2-8. [intracellular sanctuaries of Bb]
61. Dunham-Ems SM, Caimano MJ, Pal U, et al. Live imaging reveals a biphasic mode of dissemination of *Borrelia burgdorferi* within ticks. *J. Clin Invest.* 2009; 119: 3652-3665. [biofilms consist of a colony of spirochetes and cysts coated by a gelatinous, protective membrane]
62. Duray PH. 1987. The surgical pathology of human Lyme disease. An enlarging picture. *Am J Surg Pathol* S1: 47-60. [Bb in brain]
63. Duray PH and Steere AC. Clinical pathologic correlations of Lyme disease by stage. *Ann N Y Acad Sci* 1988; 539: 65-79.
64. Duray PH, et al. Invasion of human tissue *ex vivo* by *Borrelia burgdorferi*. *J. Infect. Dis.* 2005. 191(10): 1747-1754.
65. Durovska J, Bazovska S, Ondrisova M, and Pancak J. 2010. Our experience with examination of antibodies against antigens of *Borrelia burgdorferi* in patients with suspected Lyme disease. *Bratisl. Lek. Listy* 2010; 111(3): 153-155.
66. Dvorakova J, and Celer V. [Pharmacological aspects of Lyme borreliosis] *Seska Slov Farm.* 2004(Jul); 53(4): 159-164.
67. Ebel GD, Campbell EN, Goethert HK, Spielman A, and Telford SR. Enzootic transmission of deer tick virus in New England and Wisconsin sites. *Am. J. Trop. Med. Hyg.* 2000; 63(1-2): 36-42.
68. Ekdahl KN, Henningsson AJ, Sandholm K, Forsberg P, Ernerudh J, Ekerfelt C; Immunity in borreliosis with special emphasis on the role of complement. *Adv Exp Med Biol* 2007; 598: 198-213.
69. Embers ME, SW Barthold, JT Borda, L Bowers, L Doyle, E Hodzic, MB Jacobs, NR Hasenkampf, DS Martin, S. Narasimhan, KM Phillippi-Falkenstein, JE Purcell, MS Ratterree, and MT Philipp. Persistence of *Borrelia burgdorferi* in rhesus macaques following antibiotic treatment of disseminated infection. *PLoS ONE* 7(1): e29914. doi:10.1371/journal.pone.0029914 (2012) [Bb was cultured from rhesus macques after antibiotic treatment and confirmed by PCR.]
70. Fallon BA, Schwartzberg M, Bransfield R, Zimmerman B, Scotti A, Weber CA, and Liebowitz MR. Late-stage neuropsychiatric Lyme borreliosis. Case reports. *Psychosomatics* 1995; 36: 295-300.
71. Fallon BA, Das S, Plutchok JJ, Tager F, Liegner K, Van Heertum R. Functional brain imaging and neuropsychological testing in Lyme disease. *Clin Infect Dis* 1997; 25 (suppl 1): S57-S63.
72. Fallon BA, et al. Repeated antibiotic treatment in chronic Lyme disease. *J Spir Tick Borne Dis.* 1999; 6: 94-101.
73. Fallon BA, Keilp J, Prohovnik I, Heertum RV, Mann JJ. Regional cerebral blood flow and cognitive deficits in chronic Lyme disease. *J Neuropsychiatry Clin Neurosci* 2003; 15: 326-332.
74. Fallon BA, Keilp JG, Corbera KM, Petkova K, Britton CB, Dwyer E, et al. A randomized, placebo-controlled trial of repeated IV antibiotic therapy for Lyme encephalopathy. *Neurology* 2008; 70: 992-1003.
75. Fallon BA, Lipkin RB, Corbera KM, Yu S, Nobler MS, Keilp JG, Petkova E, Lisanby SH, Moeller JR, Slavov I, Van Heertum R, Mensh BD, and Sackeim HA. Regional cerebral blood flow and metabolic rate in persistent Lyme encephalopathy. *Arch Gen Psychiatry* 2009; 66: 554-563.
76. Feder Jr., HM and Whitaker DL. Misdiagnosis of erythema migrans. *Am. J. Med.* 1995; 99: 412-419.
77. Fein L, and Tilton RC. Bone marrow as a source for *Borrelia burgdorferi* DNA. *J Spir Tick-borne Dis* 1997; 4: 58-60.
78. Ferris J, et al. Lyme borreliosis. [letter] *Lancet* 1995; 345: 1436-1437.

79. Franz JK, O Fritze, M Rittig et al. Insights from a novel three-dimensional in vitro model of Lyme arthritis: standardized analysis of cellular and molecular interactions between *Borrelia burgdorferi* and synovial explants and fibroblasts. *Arthritis Rheum* 2001; 44: 151-162.
80. Fraser DD, Kong LI, and Miller FW. Molecular detection of persistent *Borrelia burgdorferi* in a man with dermatomyositis. *Clinical and Experimental Rheumatology* 1992; 10: 387-390.
81. Frey M, Jaulhac B, Piemont Y, Marcellin L, Boohs PM, Vautravers P, Jesel M, Kuntz JL, Monteil H, and Sabilia J. Detection of *Borrelia burgdorferi* DNA in muscle of patients with chronic myalgia related to Lyme disease. *Am J Med* 1988; 104: 591-594.
82. Fried MD, Duray P. Gastrointestinal disease in children with persistent Lyme disease: spirochetes isolated from the G.I. tract. IX Lyme Disease Foundation International Scientific Conference, Boston, MA, April 19-20, 1996.
83. Garcia-Monco JC, Benach JL. The pathogenesis of Lyme disease. *Rheum Dis Clin North Am* 1989; 15: 711-726.
84. Georgilis K, Peacocke M, and Klempner MS. Fibroblasts protect the Lyme disease spirochete, *Borrelia burgdorferi*, from ceftriaxone in vitro. *J Infect Dis* 1992; 166: 440-444.
85. Giambartolomei GH, Dennis VA, and Philipp MT. *Borrelia burgdorferi* stimulates the production of interleukin-10 in peripheral blood mononuclear cells from uninfected humans and rhesus monkeys. *Infect Immun* 1998; 66: 2691-2697. [suppression of harmful immune responses: defense stratagem of *B. burgdorferi*]
86. Girschick HJ, Huppertz HI, Rüssmann H, Krenn V, and Karch H. Intracellular persistence of *Borrelia burgdorferi* in human synovial cells. *Rheumatol Int* 1996; 16: 125-132. [intracellular sanctuaries of Bb]
87. Goodman JL, Jurkovich P, Kodner C, and Johnson RC. Persistent cardiac and urinary tract infections with *Borrelia burgdorferi* in experimentally infected Syrian hamsters. *J Clin Microbiol* 1991; 29: 894-896.
88. Grignolo MC, Buffrini L, Monteforte P, and Rovetta G. Reliability of a polymerase chain reaction (PCR) technique in the diagnosis of Lyme borreliosis. *Minerva Med* 2001; 92(1): 29-33. [Article in Italian]
89. Gruntar I, et al. Conversion of *Borrelia garinii* cystic forms to motile spirochetes *in vivo*. *APMIS* 2001; 109(5): 383-388. [Persistence occurs when spirochetes change physical characteristics by converting to dormant cysts, and vis versa.]
90. Halperin JJ, Luft BJ, Anand AK, Roque CT, Alvarez O, Volkman DJ, Dattwyler RJ. Lyme neuroborreliosis: central nervous system manifestations. *Neurology* 1989; 39: 753-759. [hyperintensities persist after treatment]
91. Halperin JJ. Prolonged Lyme disease treatment: enough is enough. *Neurology* 2008; 70(13): 986-987.
92. Harvey WT and Salvato P. 'Lyme disease': ancient engine of an unrecognized borreliosis pandemic? *Med Hypotheses* 2003; 60: 742-759.
93. Hassett AL, Radvanski DC, Buyske S, Savage SV, and Sigal LH. Psychiatric comorbidity and psychological factor in patients with "chronic Lyme disease." *Am. J. Med.* 2009; 122(9): 843-850.
94. Hassler D, Riedel K, Zorn J and Preac-Mursic V. Pulsed high-dose cefotaxime therapy in refractory Lyme borreliosis (letter). *Lancet* 1991; 338: 193.
95. Häupl T, Hahn G, Rittig M, Krause A, Schoerner C, Schonherr U, Kalden JR, and Burmester GR. Persistence of *Borrelia burgdorferi* in ligamentous tissue from a patient with chronic Lyme borreliosis. *Arthritis Rheum* 1993; 36(11): 1621-1626. [Repeated antibiotic treatment necessary to stop the progression of disease but did not completely eliminate Bb from all sites of infection. Bb cultured from ligament sample; intracellular sanctuaries for Bb]
96. Henneberg JP, and Neubert U. *Borrelia burgdorferi* group: *in vitro* antibiotic sensitivity. *Orv Hetil* 2002; 143: 1195-1198.

97. Hilton E, Tramontano A, DeVoti J, and Sood SK. Temporal study of immunoglobulin M seroreactivity to *Borrelia burgdorferi* in patients treated for Lyme borreliosis. *J Clin Microbiol* 1997; 35(3): 774-776.
98. Hodzic E, Feng S, and Barthold SW. Stability of *Borrelia burgdorferi* outer surface protein C under immune selection pressure. *J Infect Dis* 2000; 181: 750-753.
99. Hodzic E, Feng S, Holden K, Freet KJ, and Barthold SW. Persistence of *Borrelia burgdorferi* following antibiotic treatment in mice. *Antimicrob Agents Chemother* 2008; 52: 1728-1736. [in mice: following antibiotic treatment; mice remained infected with infectious spirochetes.]
100. Holl-Weiden A, Suerbaum S, and Girschick HJ. Seronegative Lyme arthritis. *Rheumatology International* 2007; 11: 1091-1093.
101. Kalish RA, Leong JM, and AC Steere. Association of treatment-resistant chronic Lyme arthritis with HLA-DR4 and antibody reactivity to OspA and OspB of *Borrelia burgdorferi*. *Infect Immun* 1993; 61: 2774-2779.
102. Karma A, Stenborg T, Summanen P, Immonen I, Mikkila H, and Seppala I. Long-term follow-up of chronic Lyme neuroretinitis. *Retina* 1996; 16: 505-509.
103. Keat AC, and Hughes R. Infectious agents in reactive arthritis. *Curr Opin Rheumatol* 1993; 5: 414-419.
104. Keller TL, Halperin JJ, and Whitman M. PCR detection of *Borrelia burgdorferi* DNA in cerebrospinal fluid of Lyme neuroborreliosis patients. *Neurology* 1992; 43: 32-42.
105. Kersten A, Poitschek C, Rauch S, and Aberer E. Effects of penicillin, ceftriaxone, and doxycycline on morphology of *Borrelia burgdorferi*. *Antimicrob Agents Chemother* 1995; 39: 1127-1133.
106. Keszler K, and Tilton RC. Persistent PCR positivity in a patient being treated for Lyme disease. *Journal of Spirochetal and Tick-Borne Diseases* 1995; 2: 57-58.
107. Kirsch M,, Ruben FL, Steere AC, Duray PH, Norden CW, Winkelstein A. Fatal adult respiratory distress syndrome in a patient with Lyme disease. *JAMA* 1988; 259(18) 2737-2739.
108. Klempner MS, Noring R, and Rogers RA. Invasion of human skin fibroblasts by the Lyme disease spirochetes, *Borrelia burgdorferi*. *J Inf Dis* 1993; 167: 1074-81.
109. Kraiczy P, Hellwage J, Skerka C, Becker H, Kirschfink M,, Simon MM, et al. Complement resistance of *Borrelia burgdorferi* correlates with the expression of BbCRASP-1, a novel linear plasmid-encoded surface protein that interacts with human factor H and FHL-1 and is unrelated to Erp proteins. *J Biol Chem* 2004; 279: 2421-2429.
110. Krupp LB, Masur D, Schwartz J, Coyle PK, Langenback IJ, and Fernquist SK. Cognitive functioning in late Lyme borreliosis. *Arch Neurol* 1999; 48: 1125-1129.
111. Krupp LB, Hyman LG, Grimson R, Coyle PK, Melville P, Ahnn S, et al. Study and treatment of post Lyme disease (STOP-LD): a randomized double masked clinical trial. *Neurology* 2003; 60: 1923-1930.
112. Krüger H, Helm E, Schuknecht B, and Scholz S. Acute and chronic neuroborreliosis with and without CNS involvement: a clinical, MRI, and HLA study of 27 cases. *J Neurol* 1991; 238: 271-280.
113. Kullberg BJ, Berende A, van der Meer JW. The challenge of Lyme disease: tired of the Lyme wars. *Neth J Med* 2011; 69: 98-100. [refutes Klempers {2001} conjecture that long-term antibiotics don't work]
114. Latov N, Wu AT, Chin RL, Sander HW, Alaedini A, and Brannagan TH. Neuropathy and cognitive impairment following vaccination with the OspA protein of *Borrelia burgdorferi*. *J Peripher Nerv Syst* 2004; 9: 165-167.
115. Lavoie PE. Failure of published antibiotic regimens in Lyme borreliosis: observations on prolonged oral therapy. Abstract. Lyme Borreliosis International Conference, Sweden, 1990.
116. Lavoie PE. Protocol from Rakef's: explains persistence of infection despite "standard" courses of antibiotics. *Lyme Times*, Lyme Disease Resource Center, 1992; 2: 25-27. Reprinted from Conn's Current Therapy, 1991.

117. Lawrence C, Lipton RB, Lowy RD, and Coyle PK. Seronegative chronic relapsing neuroborreliosis. *Eur Neurol* 1995; 35(2): 113-117. [Patient's CSF was positive for complex anti-*Bb* antibodies, *B. burgdorferi* nucleic acids and free antigen despite aggressive antibiotic therapy.]
118. Lawrenz MB, Hardham JM, Owens RT, Nowakowski J, Steere AC, Wormser GP, and Norris SJ. Human antibody responses to vlsE antigenic variation protein of *Borrelia burgdorferi*. *J Clin Microbiol* 1999; 37: 3997-4004.
119. Liang FT, Steere AC, Marques AR, Johnson BJB, Miller JN, and Philipp MT. Sensitive and specific serodiagnosis of Lyme disease by enzyme-linked immunosorbent assay with a peptide based on an immunodominant conserved region of *Borrelia burgdorferi* VlsE. *J Clin Microbiol* 1999; 37: 3990-3996.
120. Liang FT, Jacobs MB, Bowers LC, Philipp MT. An immune evasion mechanism for spirochetal persistence in Lyme borreliosis. *J Exp Med* 2002; 195: 415-422.
121. Liegner KB. Lyme disease: the sensible pursuit of answers. *J Clin Microbiol* 1993; 31: 1961-1963.
122. Liegner KB, Shapiro JR, Ramsay D, Halperin AJ, Hogrefe W, and Kong L. Recurrent erythema migrans despite extended antibiotic treatment with minocycline in a patient with persisting *Borrelia burgdorferi* infection. *J Am Acad Dermatol* 1993; 28: 312-314. [Eleven months following treatment, T-cell stimulation test with Bb antigens were strongly positive; a year later, paired serum and CSF samples were strongly positive.]
123. Liegner KB, Duray P, Agricola M, Rosenkilde C, Yannuzzi LA, Ziska M, Tilton RC, Hulinska D, Hubbard J, and Fallon BA. Lyme disease and the clinical spectrum of antibiotic responsive chronic meningoencephalomyelitides. *J Spir and Tick-Borne Dis* 1997; 4: 61-73. [live culture of Bb after antibiotic treatment]
124. Livengood JA and Gilmore RD, Jr. Invasion of human neuronal and glial cells by an infectious strain of *Borrelia burgdorferi*. *Microbes and Infection*. 2006; 8: 2832-2840. [intracellular sanctuaries of Bb]
125. Lavoie PE. Failure of published antibiotic regimens in Lyme borreliosis: observations on prolonged oral therapy. Abstract. Lyme Borreliosis International Conference, Sweden, 1990.
126. Lavoie PE. Protocol from Rakef's: explains persistence of infection despite "standard" courses of antibiotics. *Lyme Times*, Lyme Disease Resource Center, 1992; 2: 25-27. Reprinted from Conn's Current Therapy, 1991.
127. Lawrence C, Lipton RB, Lowy RD, and Coyle PK. Seronegative chronic relapsing neuroborreliosis. *Eur Neurol* 1995; 35(2): 113-117. [Patient's CSF was positive for complex anti-*Bb* antibodies, *B. burgdorferi* nucleic acids and free antigen despite aggressive antibiotic therapy.]
128. Lawrenz MB, Hardham JM, Owens RT, Nowakowski J, Steere AC, Wormser GP, and Norris SJ. Human antibody responses to vlsE antigenic variation protein of *Borrelia burgdorferi*. *J Clin Microbiol* 1999; 37: 3997-4004.
129. Liang FT, Steere AC, Marques AR, Johnson BJB, Miller JN, and Philipp MT. Sensitive and specific serodiagnosis of Lyme disease by enzyme-linked immunosorbent assay with a peptide based on an immunodominant conserved region of *Borrelia burgdorferi* VlsE. *J Clin Microbiol* 1999; 37: 3990-3996.
130. Liang FT, Jacobs MB, Bowers LC, Philipp MT. An immune evasion mechanism for spirochetal persistence in Lyme borreliosis. *J Exp Med* 2002; 195: 415-422.
131. Liegner KB. Lyme disease: the sensible pursuit of answers. *J Clin Microbiol* 1993; 31: 1961-1963.
132. Liegner KB, Shapiro JR, Ramsay D, Halperin AJ, Hogrefe W, and Kong L. Recurrent erythema migrans despite extended antibiotic treatment with minocycline in a patient with persisting *Borrelia burgdorferi* infection. *J Am Acad Dermatol* 1993; 28: 312-314. [Eleven months following treatment, T-cell stimulation test with Bb antigens were strongly positive; a year later, paired serum and CSF samples were strongly positive.]
133. Liegner KB, Duray P, Agricola M, Rosenkilde C, Yannuzzi LA, Ziska M, Tilton RC, Hulinska D, Hubbard J, and Fallon BA. Lyme disease and the clinical spectrum of antibiotic responsive

- chronic meningoencephalomyelitides. *J Spir and Tick-Borne Dis* 1997; 4: 61-73. [live culture of Bb after antibiotic treatment]
134. Livengood JA and Gilmore RD, Jr. Invasion of human neuronal and glial cells by an infectious strain of *Borrelia burgdorferi*. *Microbes and Infection*. 2006; 8: 2832-2840. [intracellular sanctuaries of Bb]
 135. Hodzic E, Feng S, Holden K, Freet, KJ, and Barthold SW. Persistence of *Borrelia burgdorferi* following antibiotic treatment in mice. *Antimicrobial Agents and Chemotherapy* 2008; 52: 1728-1736. [Persistence of Bb in mice]
 136. Hudson BJ, Stewart M, Lennox VA, Fukunaga M, Yabuki M, Macorison H, Kitchener-Smith J. Culture-positive Lyme borreliosis. *Med J Aust*. 1998; 168(10): 500-502.
 137. Lawrence C, Lipton RB, Lowy FD, and Coyle PK. Seronegative chronic relapsing neuroborreliosis. *Eur. Neurol*. 1995; 35(2): 113-117.
 138. Livengood JA, and Gilmore, RD, Jr. Invasion of human neuronal and glial cells by an infectious strain of *Borrelia burgdorferi*. *Microbes and Infection* 2006; 8: 2832-2840.
 139. Logigian EL, Kaplan RF, and Steere AC. Chronic neurologic manifestations of Lyme disease. *N Eng J Med* 1990; 323:1438-44.
 140. Logigian EL, Johnson KA, Kijewski MF, Kaplan RF, Becker JA, Jones KJ, Garada BM, Holman BL, Steere AC. Reversible cerebral hyperperfusion in Lyme encephalopathy. *Neurology* 1997; 49: 1661-1670.
 141. López-Andreu JA, Ferrís J, Canosa CA, Sala-Lizárraga JV. Treatment of late Lyme disease: a challenge to accept. *J Clin Microbiol* 1994; 32:1415-1416.
 142. Luft BJ, Steinman CR, Neimark HC, Muralidhar B, Rush T, Finkel MF, Kundel M, and Dattwyler RJ. Invasion of the CNS by *Borrelia burgdorferi* in acute disseminated infection. *JAMA* 1992; 267: 1364-1367.
 143. Lyme Disease Foundation. The controversies surrounding Lyme disease diagnosis and treatment and why it is not uncommon for patients to experience persistent symptoms despite receiving conventional (short-term) antibiotic therapy for Lyme disease. www.lyme.org/lymelight/trtcontrov.html
 144. Ma Y, Sturrock A, and Weis JJ. Intracellular localization of *Borrelia burgdorferi* within human endothelial cells. *Infect Immun* 1991; 59: 671-678.
 145. MacDonald AB and Miranda JM. Concurrent neocortical borreliosis and Alzheimer's disease. *Human Pathol* 1987; 18: 759-761.
 146. MacDonald AB. Concurrent neocortical borreliosis and Alzheimer's disease: demonstration of a spirochetal cyst form. *Ann NY Acad Sci* 1988; 539: 468-470.
 147. MacDonald AB, Berger BW, and Schwan TG. Clinical implications of delayed growth of the Lyme disease spirochete, *Borrelia burgdorferi*. *Acta Trop* 1990 48; (2): 89-94.
 148. MacDonad AB. In situ DNA hybridization study of granulovacuolar degeneration in human Alzheimer autopsy neurons for flagellin b transcriptomes of *Borrelia burgdorferi*. *Alzheimer's Dis Dementia* 2006; 2 (Suppl. 1): S207.
 149. MacDonald AB. Plaques of Alzheimer's disease originate from cysts of *Borrelia burgdorferi*. *Med Hypotheses* 2006; 67: 592-600. doi:10.1016/j.mehy.2006.02.035.
 150. MacDonald AB. Cystic borrelia in Alzheimer's disease and in non-dementia neuroborreliosis. *Alzheimer's Dementia* 2006; 2 (Suppl. 1):S433.
 151. MacDonald AB. Transfection "Junk" DNA — A link to the pathogenesis of Alzheimer's disease? *Med Hypotheses* 2006; 66: 1140-1141.
 152. MacDonald AB. Alzheimer's neuroborreliosis with *trans*-synaptic spread of infection and neurofibrillary tangles derived from intraneuronal spirochetes. *Med Hypotheses* 2007; 68: 822-825. [7 of 10 cases of Alzheimer's disease had *B. burgdorferi* in their brains].
 153. MacDonald AB. Biofilms of *Borrelia burgdorferi* on chronic cutaneous borrelia. *Am J Clin Pathol* 2008; 129: 988-989.

154. MacDonald, AB. *Borrelia burgdorferi* tissue morphologies and imaging methodologies. Eur J Clin Microbiol Infect Dis 2013. DOI 10.1007/s10096-013-1853-5
155. Mahmoud AAF. The challenge of intracellular pathogens (editorial). N Engl J Med 1992; 326: 761-762.
156. Malane MS, Grant Kels JM, Feder Hm Jr. et al. Diagnosis of Lyme disease based on dermatologic manifestations. Ann Intern Med 1991; 114:490-498. [chronic Lyme borreliosis].
157. Malawista SE, Barthold SW, and Persing DH. Fate of *Borrelia burgdorferi* DNA in tissues of infected mice after antibiotic treatment. J Infect Dis 1994; 170: 1312-1316.
158. Malawista SE. Resolution of Lyme arthritis, acute or prolonged: a new look. Rheuma 2000 (May 29 issue).
159. Manak MK, González-Villaseñor LI, Crush-Stanton S, and Tilton RC. Use of PCR assays to monitor the clearance of *Borrelia burgdorferi* DNA from blood following antibiotic therapy. J Spir Tick-Borne Dis 1997; 4: 11-20.
160. Maraspin V, Ruzic-Sabljić E, Strle F, Cimperman J, Jereb M, Preac-Mursic V. Alpc Adria Microbiol J. Persistence of *Borrelia burgdorferi* after treatment with antibiotics.1995; 3: 211-216.
161. Maraspin V, Cimperman J, Lotrič-Furlan S, Ružić-Sabljić E, Jurca T, Picken RN, and Strle F. Solitary borrelial lymphocytoma in adult patients. Wien Klin Wochenschr 2002; 114: 515-523.
162. Marlovits S, Khanah G, Striessniq G, Vécsei V, and Stanek G. Emergence of Lyme arthritis after autologous chondrocyte transplantation. Arthritis Rheum. 2004; 50: 259-264.
163. Masters EJ, Lynxwiler P, and Rawlings J. Spirochetemia after continuous high-dose oral amoxicillin therapy. Infect Dis Clin Practice 1995; 3: 207-208. [Following six months of treatment, patient relapsed and Bb was cultured from blood.]
164. Mattman LH. Cell wall deficient forms: stealth pathogens. 2nd edition. CRC Press, Inc., Boca Raton, FL. 1993. [change in physical characteristics; change of spirochetes to other pleomorphic forms, i.e., cell wall deficient forms, namely cysts.]
165. Meier P, Blatz R, Gau M, Spencker FB, Wiedermann P. [Pars plana vitrectomy in *Borrelia burgdorferi* endophthalmitis][German]. Klin Monatsbl Augenheilkd 1998; 213(6): 351-354.
166. Miklossy J. Alzheimer's disease — a spirochetosis? NeuroReport 1993; 4: 841-848.
167. Miklossy J, Kasas S, Janzer RC, Ardizzoni F, and Loos H. Further morphological evidence of a spirochetal etiology of Alzheimer's disease. NeuroReport 1994; 5: 1201-1204.
168. Miklossy J, Gern L, Darekar P, Janzer RC, Loos H. Senile plaques, neurofibrillary tangles and neuropil threads contain DNA? J Spirochetal and Tick-borne Dis 1995; 2: 1-5.
169. Miklossy JM, Khalili K, Gern L, Ericson RL, Darekar P, Bolle L, Hurlimann J, and Paster BJ. *Borrelia burgdorferi* persists in the brain in chronic Lyme neuroborreliosis and may be associated with Alzheimer's disease. J Alzheimers Dis 2004; 6: 639-649.
170. Miklossy J, Rosemberg S, and McGeer PL; Beta amyloid deposition in the atrophic form of general paresis. In *Alzheimer's Disease: New advances*. Medimond. Proceedings of the 10th International Congress on Alzheimer's Disease. Edited by: Iqbal K, Winblad B, and Avila J; 2006: 429-433.
171. Miklossy J, Kris A, Radenovic A, Miller L, Forro L, Martins R, Reiss K, Darbinian N, Darekara P, Mihaly L, and Khalili K. Beta amyloid deposition and Alzheimer's type changes induced by *Borrelia* spirochetes. Neurobiol Aging 2006; 27: 228-236.
172. Miklossy J. Chronic inflammation and amyloidogenesis in Alzheimer's disease — role of spirochetes. J Alzheimers Dis 2008; 13: 381-391.
173. Miklossy, J. 2008. Biology and neuropathology of dementia in syphilis and Lyme disease. In *Handbook of Clinical Neurology*, Vol. 89. C. Duyckaerts, I. Litvan (eds.). Elsevier, Amsterdam, Netherlands. p. 825-844. [Persistence of *B. burgdorferi* is evident in dementia patients.]
174. Miklossy J, Kasas S, Zurn AD, McCall S, Yu S, and McGeer PL. Persisting atypical and cystic forms of *Borrelia burgdorferi* and local inflammation in Lyme neuroborreliosis. J Neuroinflammation 2008; 5: 40-57.
175. Miklossy, J. 2011. Alzheimer's disease—a neurospirochetosis. Analysis of the evidence following Koch's and Hill's criteria. Journal of Neuroinflammation 8:90. [Spirochetes were observed in the

- brain in more than 90% of Alzheimer's disease. Persistence occurs when spirochetes change physical characteristics by converting to dormant cysts.]
176. Miklosy, J. 2011. Alzheimer's disease – a neurospirochetosis. Analysis of the evidence following Koch's and Hill's criteria. 2011; 8: 90 (<http://www.jneuroinflammation.com/content/8/1/90>) [91% of Alzheimer's patients sampled were positive for spirochetes; 25% of Alzheimer's patients analyzed had *B. burgdorferi* spirochetes in their brains]
 177. Miller JC, K Narayan, B Stevenson, and AR Pachner. Expression of *Borrelia burgdorferi* erp genes during infection of non-human primates. Microb Pathol. 2005; 39: 27-33. [in monkeys]
 178. Montgomery RR, Nathanson MH, and Malawista SE. The fate of *Borrelia burgdorferi* within endothelial cells. Infect Immun 1991; 59: 671-678.
 179. Montgomery RR, MH Nathanson, and SE Malawista. The fate of *Borrelia burgdorferi*, the agent for Lyme disease, in mouse macrophages. Destruction, survival, recovery. J Immunol 1993; 150: 909-915. [in mice macrophages]
 180. Moriarty TJ, Norman MU, Colarusso P, Bankhead T, Kubes P, and Chaconas G. 2008. Real-time high resolution 3D imaging of the Lyme disease spirochete adhering to and escaping from the vasculature of a living host. PLoS Pathog 4(6):e1000090. doi:10.1371/journal.ppat.1000090.
 181. Moses JM, RS Riseberg, and JM Mansbach. Lyme disease presenting with persistent headache. Pediatrics 2003; 112: 477-449.
 182. Mursic VP, Wanner G, Reinhardt S, Wilske B, Busch U, and Marget W. Formation and cultivation of *Borrelia burgdorferi* spheroplast L-form variants. Infection 1996; 24(4): 335.
 183. Nanagara R, Duray PH, and Schumacher HR, Jr. Ultrastructural demonstration of spirochetal antigens in synovial fluid and synovial membrane in chronic Lyme disease: possible factors contributing to persistence of organisms. Hum Pathol 1996; 27(10): 1025-1034. [intracellular sanctuaries of Bb]
 184. Nocton JJ, Dressler F, Rutledge BJ, Rys PN, Persing DH, and Steere AC. Detection of *Borrelia burgdorferi* DNA by polymerase chain reaction in synovial fluid from patients with Lyme arthritis. N Eng J Med 1994; 330: 229-234. [Of 19 Lyme arthritis patients treated with either parenteral antibiotics or long courses of oral antibiotics, PCR confirmed Bb detected in synovial fluid of 37% of patients.]
 185. Nocton JJ, Bloom BJ, Rutledge BJ, Persing DJ, Logigian EL, Schmid CH, and Steere AC. Detection of *Borrelia burgdorferi* DNA by polymerase chain reaction in cerebrospinal fluid in Lyme neuroborreliosis. J. Infect Dis 1996; 174: 623-627.
 186. Norgard MV, Riley BS, Richardson JA, et al. 1995. Dermal inflammation elicited by synthetic analogs of *Treponema pallidum* and *Borrelia burgdorferi* lipoproteins. Infect Immun 63: 1507-1515.
 187. Oksi J, Mertsola J, Reunanen M, Marjamäki M, Viljanen MK. Subacute multiple-site osteomyelitis caused by *Borrelia burgdorferi*. Clin Infect Dis 1994; 19(5): 891-896.
 188. Oksi J, Uksila J, Marjamäki M, Nikoskelainen J, and Viljanen MK. Antibodies against whole sonicated *Borrelia burgdorferi* spirochetes, 41-kilodalton flagellin, and P39 protein in patients with PCR- or culture-proven late Lyme borreliosis. J Clin Microbiol 1995; 33: 2260-2264.
 189. Oksi J, Kalimo H, Marttila RJ, Marjamäki M, Sonninen P, Nikoskelainen J, and Viljanen MK. Inflammatory brain changes in Lyme borreliosis. A report on three patients and review of literature. Brain 1996; 119(6): 2143-2154.
 190. Oksi J, Nikoskelainen J, and Viljanen MK. Comparison of oral cefixime and intravenous ceftriaxone followed by oral amoxicillin in disseminated Lyme borreliosis. Eur J Clin Microbiol Int Dis 1998; 17: 715-719.
 191. Oksi J, Marjamäki M, Nikoskelainen J, and Viljanen MK. *Borrelia burgdorferi* detected by culture and PCR in clinical relapse of disseminated Lyme borreliosis. Ann Med 1999; 31(3): 225-232. [40% (13% of 32) patients had clinical relapses that were PCR or culture-confirmed.]
 192. Pacheco e Silva AC. Espirochetose dos centros nervos Memorias do hospicio de Juguery. 1927, III-IV (3-4): 1-27.

193. Pachner AR, Delaney E, and O'Neill T. Neuroborreliosis in the nonhuman primate: *Borrelia burgdorferi* persists in the central nervous system. *Ann Neurol* 1995; 38: 667-9. [in monkeys].
194. Pachner AR, J Basta, E Delaney, D Hulinska. Localisation of *Borrelia burgdorferi* in murine Lyme borreliosis by electron microscopy. *Am J Trop Med Hyg* 1995; 52: 128-133.
195. Pachner AR, Cadavid D, Shu G, Dail D, Pachner S, Hodzic E, and Barthold SW. Central and peripheral nervous system infection, immunity, and inflammation in the NHP model of Lyme borreliosis. *Ann Neurol* 2001; 50: 330-338. [in monkeys]
196. Pachner AR, D Dail, K Narayan, K Dutta, and D Cadavid. Increased expression of B-lymphocyte chemoattractant, but not pro-inflammatory cytokines, in muscle tissue in rhesus chronic Lyme borreliosis. *Cytokine* 2002; 19: 297-307. [in monkeys]
197. Pachner AR, Basta J, Delaney E, and Hulinska D. Localization of *Borrelia burgdorferi* in murine Lyme borreliosis by electron microscopy. *Am J Trop Med Hyg* 1995; 52: 128-133.
198. Pahl A, Kühbrandt U, Brune K, Röllinghoff M, and Gessner A. Quantitative detection of *Borrelia burgdorferi* by real-time PCR. *J Clin Microbiol* 1999; 37: 1958-1963.
199. Pal GS, Baker JT, and Wright DJM. Penicillin resistant *Borrelia* encephalitis responding to cefotaxime. *Lancet* 1988; 338: 50-51.
200. Reimers CD, de Koing J, Neubert U, Preac Mursic V, Koster JG, Muller Felber W, Pongratz DE, and Duray PH. *Borrelia burgdorferi* myositis: report of eight patients. *J Neurol* 1993; 240(5): 278-283.
201. Petrovic M, Vogelaers D, Van Renterghem L, Carton D, De Reuck J, and Afschrift M. Lyme borreliosis – review of the late stages and treatment of four cases. *Acta Clin Belg.* 1998; 53: 178-183.
202. Pfister HW, Preac Mursic V, Wilske B, Schielke E, Sorgel F, Einhaupl KMJ. Randomized comparison of ceftriaxone and cefotaxime in Lyme neuroborreliosis. *Infect Dis* 1991; 163(2): 311-318. [In one patient, Bb as isolated from the cerebrospinal fluid 7.5 months after ceftriaxone therapy and, thus, showing that extended therapy is necessary.]
203. Phillips SE, Mattman LH, Hulinska D, and Moayad H. A proposal for the reliable culture of *Borrelia burgdorferi* from patients with chronic Lyme disease, even from those aggressively treated. *Infection* 1998; 26: 364-67.
204. Phillips SE, Harris NS, Horowitz R, Johnson L, Stricker RB. Lyme disease: scratching the surface. *Lancet* 2005; 366: 1771.
205. Phillips SE, Burrascano JJ, Harris NS, Johnson L, Smith PV, Stricker RB. Chronic infection in 'post-Lyme borreliosis syndrome.' *Int J Epidemiol* 2005; 34: 1439-1440.
206. Picken RN, Strle F, Picken MM et al. Identification of three species of *Borrelia burgdorferi* sensu lato (*B. garinii*, *B. afzelii*) among isolates from acrodermatitis chronica atrophicans lesions. *J Invest Dermatol* 1998; 110; 211-214. [chronic Lyme borreliosis].
207. Preac-Mursic V, Wilske B, Schierz G, et al. Repeated isolation of spirochetes from the cerebrospinal fluid of a patient with meningoradiculitis Bannwarth syndrome. *Eur J Clin Microbiol* 1984; 3: 564-565.
208. Preac-Mursic V, Weber K, Pfister HW, Wilske B, Gross B, Baumann A, and Prokop J. Survival of *Borrelia burgdorferi* in antibioticly treated patients with Lyme borreliosis. *Infection* 1989; 17(6): 355-359.
209. Preac-Mursic V, Patsouris E, Wilske B, Reinhardt S, Gross, and Mehraein P. Persistence of *Borrelia burgdorferi* and histopathological alterations in experimentally infected animals. A comparison with histopathological findings in human Lyme disease. *Infection* 1990; 18: 332-341.
210. Preac-Mursic V, Pfister HW, Spiegel H, Burk K, Wilske B, Reinhardt S, and Boehmer R. First isolation of *Borrelia burgdorferi* from an iris biopsy. *J Clin Neuroophthalmol* 1993; 13(3): 155-161. [Patient with blurred vision treated with two separate month-long cycles of tetracycline had symptoms persist for several years. Bb cultured from iris biopsy.]
211. Preac Mursic V, Wanner G, Reinhardt S, Wilske B, Busch U, Marget W. Formation and cultivation of *Borrelia burgdorferi* spheroplast-L-form variants. *Infection* 1996; 24: 218-226.

212. Preac Mursic V, Marget W, Busch U, Rigler DP, Hagl S. Kill kinetics of *Borrelia burgdorferi* and bacterial findings in relation to the treatment of Lyme borreliosis. *Infection* 1996; 24(1): 9-16. [Bb was isolated by culture in five patients, four of whom had previously tested antibody-negative.]
213. Priem S, Burmester GR, Kamradt T, Wolbart K, Rittig MG, and Krause A. Detection of *Borrelia burgdorferi* by polymerase chain reaction in synovial membrane, but not in synovial fluid from patients with persisting Lyme arthritis after antibiotic therapy. *Ann Rheum Dis* 1998; 57(2): 118-121. [After antibiotic treatment, synovial membrane still demonstrates spirochetes.][Although PCR was negative in synovial fluid and urine, PCR confirmed Bb in synovial membrane of four previously treated patients with Lyme arthritis; intracellular sanctuaries of Bb]
214. Reid MC, Schoen RT, Evans J, Rosenberg JC, and Horwitz RI. The consequences of overdiagnosis and overtreatment of Lyme disease: an observational study. *Ann. Intern. Med.* 1998; 128(5): 354-362.
215. Reimers CD, de Koning J, Neubert U, Preac Mursic V, Koster JG, Muller Felberl W, Pongratz DE, and Duray PH. *Borrelia burgdorferi* myositis: report of eight patients. *J Neurol* 1993; 240(5):278-283.
216. Rittig MG, Häupl T, Krause A, Kressel M, Groscurth P, Burmester GR. *Borrelia burgdorferi*-induced ultrastructural alterations in human phagocytes: a clue to pathogenicity? *J Pathol* 1994; 173: 269-282.
217. Roberts ED, Bohm RP, Jr., Cogswell FB, Lanners HN, Lowrie RC, Jr., Povinelli L, Piesman J, and Philipp MT. Chronic Lyme disease in the rhesus monkey. *Lab Invest* 1995; 72: 146-160.
218. Roháčová H, Hancil J, Hulinská D, Mailer H, Havlik J. Ceftriaxone in the treatment of Lyme neuroborreliosis. *Infection*. 1996 (Jan-Feb); 24(1): 88-90.
219. Roelcke U, Barnett W, Wilder-Smith E, Sigmund D, and Hacke W. Untreated neuroborreliosis: Bannwarth syndrome evolving into acute schizophrenia-like psychosis. *J Neurol* 1992; 239: 129-131.
220. Ruzic-Sabljic E, Strle F, and Cimperman J. The *Ixodes ricinus* tick as a vector of *Borrelia burgdorferi* in Slovenia. *Eur J Epidemiol* 1993; 9: 396-400.
221. Sala-Lizarraga JA, Salcede-Vivo J, Ferris J, Lopez-Andreu JA. Lyme borreliosis [Letter] *Lancet* 1990; 345: 1436-1437.
222. Sapi E, and MacDonald A. Biofilms of *Borrelia burgdorferi* in chronic cutaneous borreliosis. *Am. J. Clin. Pathol.* 2008; 129: 988-989. [biofilms consist of a colony of spirochetes and cysts coated by a gelatinous, protective membrane]
223. Sapi E, Kaur N, Anyanwu S, Luecke DF, Datar A, Patel S, Rossi M, Stricker RB. Evaluation of in vitro antibiotic susceptibility of different morphologic form of *Borrelia burgdorferi*. *Drug Resist.* 2011; 4: 97-113. Epub 2011 May 3. [biofilms consist of a colony of spirochetes and cysts coated by a gelatinous, protective membrane]
224. Sapi E, Bastian SL, Mpoy CM, Scott S, Rattelle A, Pabbati N, Poruri A, Buruga D, Theophilus PAS, Pham TV, Datar A, Dhaliwai NK, MacDonald A, Rossi MJ, Sinha SK, and Luecke DF. 2012. Characterization of biofilm formation by *Borrelia burgdorferi* *in vitro*. *PLOS One* 7(10): e48277. doi: 10.1371/journal.pone.0048277 [biofilms consist of a colony of spirochetes and cysts coated by a gelatinous, protective membrane]
225. Schoen RT, Aversa JM, Rahn DW, and Steere AC. Treatment of refractory chronic Lyme arthritis with arthroscopic synovectomy. *Arthritis Rheum* 1991; 34(8): 1056-1060.
226. Schlesinger P, Duray P, Burke B, Steere A, and Stillman A. Maternal-fetal transmission of the Lyme disease spirochete *Borrelia burgdorferi*. *Ann Intern Med* 1985; 103: 67-68.
227. Schmidli J, Hunziker T, Moesli P, and Schaad UB. Cultivation of *Borrelia burgdorferi* from joint fluid three months after treatment of facial palsy due to Lyme borreliosis. *J Inf Dis* 1988; 158(4): 905-906. [Bb was cultured from joint fluid after treatment.]

228. Schwann TG, Piesman J, Golde WT, Dolan MC, Ros PA. Induction of an outer surface protein on *Borrelia burgdorferi* during tick feeding. Proc Natl. Acad. Sci. USA. 1995; 92: 2909-2913. [change in physical characteristics by altering immunogenicity]
229. Seiler KP, and Weis JJ. Immunity to Lyme disease: protection, pathology and persistence. Curr Opin Immunol 1996; 8: 503-509.
230. Shadick NA, Phillips CB, Logigian EL, Steere AC, Kaplan RF, Berardi VP, et al. The long-term clinical outcomes of Lyme disease. A population-based retrospective cohort study. Ann Int Med 1994; 121: 560-567.
231. Sherr VT. "Bell's palsy of the gut" and other GI manifestations of Lyme and associated disease. Practical Gastroenterology. April 2006.
232. Silverman S, Dukes EM, Johnston SS, Brandenburg NA, Sadosky A, and Huse DM. The economic burden of fibromyalgia: comparative analysis rheumatoid arthritis. Current Medical Research and Opinion 2009; 25(4) 829-840.
233. Singh SK and HJ Girschick. Molecular survival strategies of the Lyme disease spirochete *Borrelia burgdorferi*. Lancet Infect Dis 2004; 4: 575-583. [*B. burgdorferi* survives in brachytophic tissue (ligament, tendon), fibroblasts, synovial cells, endothelial cell {linings of blood and heart vessels, and lymph vessels}}, deep invaginations of cell membranes, myocytes, joints, eyes, and bones.]
234. Skogman BH, Croner S, Nordwall M, Eknefelt M, Ernerudh J, and Forsberg P. Lyme neuroborreliosis in children: a prospective study of clinical features, prognosis, and outcome. Pediatric Infect. Dis. J. 2008; 27(12): 1089-1094.
235. Stanek G, Klein J, Bittner R, and Glogar D. Isolation of *Borrelia burgdorferi* from the myocardium of a patient with long standing cardiomyopathy. N Engl J Med 1990; 322: 249-252.
236. Steere AC, Bernardi VP, Weeks KE,, Logigan EL, Ackermann R. Evaluation of the intrathecal antibody response to *Borrelia burgdorferi* as a diagnostic test for Lyme neuroborreliosis. J. Infect. Dis. 1990(June); 161(6): 1203-1209.
237. Steere AC, Taylor E, McHugh GL, and Logigian EL. The overdiagnosis of Lyme disease. J. Med. Ass. 1993 269(14): 1812-1816.
238. Steere AC, Levin RE, Molloy PJ, Kalis RA, Abraham JH, Liu NY, and Schmid CH. Treatment of Lyme arthritis. Arthritis Rheum 1994; 37: 878-888.
239. Stein SL, Solvason HB, Biggart E, and Spiegel D. A 25-year-old woman with hallucinations, hypersexuality, nightmares, and a rash. Am J Psychiatry 1996; 153: 545-551.
240. Straubinger RK, Straubinger AF, Jacobson RH, Chang Y, Summers BA, Erb HN, and Appel MJG. Two lessons from the canine model of Lyme disease: migration of *Borrelia burgdorferi* in tissues and persistence after antibiotic treatment. J Spir Tick-Borne Dis 1997; 4: 24-31. [In dogs: 30-day treatment diminished but failed to eliminate persistent infection in dogs. Antibody titers fell, but after antibiotic treatment was discontinued antibody levels began to rise again, presumably in response to proliferation of the surviving pool of spirochetes.]
241. Straubinger RK, Summers BA, Chang YF, and Appel MJG. Persistence of *Borrelia burgdorferi* in experimentally infected dogs after antibiotic treatment. J Clin Microbiol 1997; 35: 111-116.
242. Straubinger RK. PCR-based quantification of *Borrelia burgdorferi* organisms in canine tissues over a 500-day postinfection period. J Clin Microbiol 2000; 38: 2191-2199. [All 8 infected dogs previously treated with 30-day antibiotics were PCR positive from tissue samples after necrosis; 25 tissue samples per dog were used.]
243. Straubinger RK, Straubinger AF, Summers BA, and Jacobson RH. Status of *Borrelia burgdorferi* infection after antibiotic treatment and the effects of corticosteroids: an experimental study. J Inf Dis 2000; 181: 1069-1081.
244. Straubinger RK. Lyme borreliosis in dogs in recent advances in canine infectious diseases. Edited by L.E. Carmichael. International Veterinary Information Services. 2000.
245. Stricker RB, Winger EE. Decrease CD57 lymphocyte subset in patients with chronic Lyme disease. Immunology Letters. 2001. 76: 43-48.

246. Stricker RB, Burrascano JJ, and Winger EE. Long-term decrease in the CD57 lymphocyte subset in a patient with chronic Lyme disease. *Ann Agric Environ Med* 2002; 9: 111-113.
247. Stricker RB, Lautin A, and Burrascano JJ. Lyme disease: point/counterpoint. *Expert Rev Anti-Infect Ther* 2005; 3: 155-165.
248. Stricker RB and Johnson L. Persistent *Borrelia burgdorferi* infection after treatment with antibiotics and anti-tumor necrosis factor- α . *J Infect Dis* 2008; 197: 1352-1353.
249. Stricker RB, Green CL, Savely VR, Chamallas SN, and Johnson L. Benefit of intravenous antibiotic therapy in patients referred for treatment of neurologic Lyme disease. *Int J Gen Med* 2011; 4: 639-646. [refutes Klempers {2001} conjecture that long-term antibiotics don't work]
250. Stricker RB, Johnson L. Lyme disease: the next decade. *Infect. Drug Resist.* 2011; 4: 1-9. Epub 2011. Jan 7. [biofilms consist of a colony of spirochetes and cysts coated by a gelatinous, protective membrane]
251. Strle F, Preac-Mursic V, Cimperman J, Ruzic E, Maraspin V, and Jereb M. Azithromycin versus doxycycline for treatment of erythema migrans: clinical and microbiological findings. *Infection* 1993; 21(2): 83-88.
252. Strle F, Cheng Y, Cimperman J, Maraspin V, Lotric-Furlan S, Nelson JA, Picken MM, Ruzic-Sabljić E, and Picken R. Persistence of *Borrelia burgdorferi* sensu lato in resolved erythema migrans lesions. *Clin Inf Dis* 1995; 23: 380-389.
253. Strle F, Maraspin V, Lotric-Furlan, Ruzic-Sabljić E, and Cimperman J. Azithromycin and doxycycline for treatment of *Borrelia* culture-positive erythema migrans. *Infection* 1996; 24: 64-68. [Skin-positive despite repeated antibiotic treatments.]
254. Summers BA, Straubinger AF, Jacobson RH, Chang YF, Appel MJG, and Straubinger RK. Histopathological studies of experimental Lyme disease in the dog. *J Comparative Pathol* 2005; 133: 1-13.
255. Sung SY, McDowell JV, Carlyon JA, and Marconi RT. Mutation and recombination in the upstream homology box-flanked *ospE*-related genes of the Lyme disease spirochetes result in the development of new antigenic variants during infection. *Infect Immun* 2000; 68: 1319-1327.
256. Valesová M, et al. Detection of *Borrelia* in the synovial tissue from a patient with Lyme borreliosis by electron microscopy. *J. Rheumatol.* 1989;16(11): 1502-1505. [intracellular sanctuaries of Bb]
257. Valesová H, Mailer J, Havlik J, Hulínská, D, Hercogová. Long-term results in patients with Lyme arthritis following treatment with ceftriaxone. *Infection.* 1996 (Jan-Feb); 24(1): 98-102.
258. Vartiovaara I. Living with Lyme. *Lancet* 1995; 345: 842-844.
259. Vázquez M, Sparrow SS, and Shapiro ED. Long-term neuropsychologic and health outcomes of children with facial nerve palsy attributable to Lyme disease. *Pediatrics* 2003; 112(2): e93-e97.
260. Walberg P, Granlund H, Nyman D, Panelius J, and Seppälä I. Treatment of late Lyme borreliosis. *J Infection* 1994; 29: 255-261.
261. Waniek C, Prohovnik I, Kaufman MA, and Dwork AJ. Rapid progressive frontal-type dementia associated with Lyme disease. *J Neuropsychiatry Clin Neurosci* 1995; 7: 345-347. (*B. burgdorferi* detected at autopsy).
262. Wang P, Gartenhaus R, Sood SK, DeVoti J, Singer C, Dorante G, and Hilton E. Detection of *Borrelia* DNA in circulating monocytes as evidence of persistent Lyme disease. *J Spir and Tick-Borne Dis* 2000; 7: 16-19.
263. Weber K. Treatment failure in erythema migrans: a review. *Infection* 1996; 24: 73-75.
264. Weis JJ, Yang L, Seiler KP, and Silver RM. Pathological manifestations in murine Lyme disease: association with tissue invasion and spirochete persistence. *Clin Infect Dis* 1997 Suppl 1: S18-24.
265. Wienecke R, Zoehling N, Neubert U. Molecular subtyping of *Borrelia burgdorferi* in erythema migrans and acrodermatitis chronica atrophicans. *J Invest Dermatol* 1994; 103: 19-22. [chronic Lyme borreliosis].
266. Xu Q, Mcshan K, and Liang FT. Modification of *Borrelia burgdorferi* to overproduce OspA or VlsE alters its infectious behaviour. *Microbiology* 2008; 154: 3420-3429.

267. Yang L, Weis JH, Eichwald E, Kolbert CP, Persing DH, and Weis JJ. Heritable susceptibility to severe *Borrelia burgdorferi*-induced arthritis is dominant and is associated with persistence of large numbers of spirochetes in tissues. *Infect Immun* 1994; 62: 492-500.
268. Young D, Hussell T, and Dougan G. Chronic bacterial infections: living with unwanted guests. *Nat Immunol* 2002 Nov; 3(11): 1026-1032.
269. Yrjänäinen H, Hytönen J, Söderström KO, Oksi J, Hartiala K, Viljanen MK. Persistent joint swelling and borrelia-specific antibodies in *Borrelia garinii*-infected mice after eradication of vegetative spirochetes with antibiotic treatment. *Micr Infect* 2006; 8: 2044-2051. [persistence of Bb in mice]
270. Yrjänäinen H. *Borrelia burgdorferi* evades the effects of ceftriaxone treatment in mouse model. *Medica Odontologica* 2009 [thesis]
271. Yrjänäinen H, Hytönen J, Hartiala P, Oksi J, Viljanen MK. *APMIS* 2010;118(9): 665-673. [*Borrelia burgdorferi* DNA in joints and tissue adjacent to the joint is the niche of persisting *B. burgdorferi* in ceftriaxone-treated mice.]
272. Zhang JR, Hardham JM, Barbour AG, and Norris SJ. Antigenic variation in Lyme disease *Borreliae* by promiscuous recombination of VMP-like sequence cassettes. *Cell* 1997; 89: 275-285. [antigenic variation: a defense stratagem of *B. burgdorferi*]
273. Ziska MH, Donta ST, and Demarest FC. Physician preferences in the diagnosis and treatment of Lyme disease in the United States. *Infection* 1996; 24: 182-186.