

An Engineer's Approach to the Polarised World of Lyme Disease.

Michael J Cook BSc London Univ.
Retired: Semiconductor Research and
Development Engineering

Independent Researcher
5 publications on Lyme borreliosis, transmission, testing
and *B miyamotoi*
Lyme victim: diagnosed 2009

INVESTIGATION OF THE CLAIM THAT TICKS MUST BE ATTACHED FOR 24 OR 36 HOURS OR MORE

- Search for historical source of the claim.
- Identified a 1987 paper by Piesman et al which demonstrated transmission in less than 24 hours.
- A study by Piesman in 1991 used a starting time of 36 hours and found transmission in less than 36 hours.
- Transmission in less than 24 hours was confirmed in a Sood et al paper in 1996 with Piesman as a co-author.

The minimum attachment time has never been determined though systemically infected ticks are found in nature suggesting transmission at the start of feeding.

Cook MJ. Lyme borreliosis: a review of data on transmission time after tick attachment. *Int J Gen Med.* 2015;8: 1–8. doi:10.2147/IJGM.S73791

CLINICAL DIAGNOSIS

SYMPTOMS

One person's experience...
I've been a part of this patient's life for
75 years

AONM 2019 Presentation

Symptom /description	Lyme			CFS	ME		
	Patient C	HPA	NHS Choices	BBC Health	ME Assoc.	A M Ramsey	Nat Alliance for ME
General							
Fatigue, extreme weariness	✓		✓	✓	✓	✓	✓
Dizziness	✓			✓		✓	✓
Vertigo, loss of balance	✓				✓	✓	✓
Lack of temperature control/chills	✓		✓		✓	✓	✓
Nausea	✓					✓	✓
Night and day sweats	✓			✓	✓	✓	✓
Dry cough/sore throat	✓			✓	✓		✓
Flu like	✓	✓			✓	✓	✓
Headaches	✓		✓	✓	✓	✓	✓
Red circular (bulls eye) rash	Note 1		✓				
Symptoms vary in type and intensity	✓				✓	✓	✓
Painful or enlarged Lyme glands	Note 2			✓	✓		✓
Blood pressure and pulse fluctuations	✓						✓

AONM 2019 Presentation

Symptom /description	Lyme			CFS	ME		
	Patient C	HPA	NHS Choices	BBC Health	ME Assoc.	A M Ramsey	Nat Alliance for ME
Ocular							
Floaters, grey/white veils, dark fleeting shadows	✓						
Partial temporary blindness, 1-2 minutes small area of vision							
Blurred and double vision	✓					✓	✓
Light sensitivity						✓	✓
Aural							
Hearing loss	✓						
Ringling in the ears/tinnitus	✓					✓	✓
Noise sensitivity (TV/ people are too loud)	✓					✓	✓
Gastrointestinal	✓						
Bloating, diarrhoea	✓			✓	✓	✓	✓
Abdominal pain	✓			✓	✓	✓	✓

AONM 2019 Presentation

Symptom /description	Lyme			CFS	ME		
	Patient C	HPA	NHS Choices	BBC Health	ME Assoc.	A M Ramsey	Nat Alliance for ME
Musculoskeletal	✓						
Neck pain	✓		✓				✓
Knee pain/joint pain	✓		✓	✓			✓
Chest pain	✓			✓			
arthritis (pain)	✓	✓	✓				✓
Muscle pain			✓	✓		✓	✓
Neurological							
Pins & needles/numb fingers	✓		✓			✓	✓
Insomnia/vivid dreams	✓			✓	✓		✓
Clumsy	✓				✓		✓
Balance problems	✓				✓		✓
Restlessness	✓						✓
Involuntary jerking, twitching.	✓						✓
Facial palsy		✓	✓				

AONM 2019 Presentation

Symptom /description	Lyme			CFS	ME		
	Patient C	HPA	NHS Choices	BBC Health	ME Assoc.	A M Ramsey	Nat Alliance for ME
Cognitive							
Speech problems/ word search, stammer	✓				✓		✓
Confusion/concentration	✓		✓	✓		✓	✓
Short term memory loss	✓		✓	✓	✓	✓	✓
Problems with arithmetic	✓						✓
Dyslexia	✓						✓
Psychological							
Mood swings	✓				✓		
Irritability	✓			✓			
Depression, thoughts of suicide	✓		✓	✓	✓		
Anxiety	✓			✓			✓
Emotional instability						✓	

KEY MARKERS FOR LYME BORRELIOSIS

DIVERSE MULTISYSTEMIC SYMPTOMS

ONE, TWO OR MORE AT ONE TIME

RELAPSING REMITTING

Other Tick-Borne Diseases and Co-infections

More than 1400 human pathogens

More than 45 tick-borne diseases:

- More than 30 bacterial diseases with over 120 pathogenic species.
- More than 15 viral disease and 100s of species
- And Babesiosis AND OTHERS!
- AND CO-INFECTIONS

Human Tick-borne bacteria pathogens

Disease	Pathogens	Number of species	Symptoms
Anaplasmosis (human granulocytic anaplasmosis)	<i>Anaplasma phagocytophilum</i> ,	1	Fever, headache, muscle pain, malaise, chills, nausea, cough, confusion.
Babesiosis	<i>Babesia microti</i> , <i>B divergens</i> most common.	>20	Fever, headache, body ache, loss of appetite, nausea, fatigue.
Bartonellosis/cat scratch disease. Trench fever. Oroya fever. Carrion's disease. Verruca pesuana. Endocarditis. Neuroretinitis.	<i>Bartonella henselae</i> , <i>B quintana</i> , <i>B bacilliformis</i> , <i>B clarridgeiae</i> , <i>B elizabethae</i> , <i>B grahamii</i> , <i>B koehlerae</i> , <i>B naantaliensis</i> , <i>B vinsonii</i> , <i>B washoensis</i> , <i>B rochalimae</i>	18 species known human pathogens plus >40 others.	Baronellosis: fatigue, muscle pain, headache, insomnia, blurred vision, arthralgia.
Human monocytic ehrlichiosis, human ewingii ehrlichiosis	<i>Ehrlichia chaffeensis</i> , <i>E ewingii</i> , <i>E canis</i> , <i>E muris</i> , <i>E ruminantium</i> , <i>E sennetsu</i>	6	Fever, headache, malaise, muscle aches.
Lyme disease, neuroborreliosis	<i>Borrelia burgdorferii sensu stricto</i> , <i>B afzelii</i> , <i>B garinii</i> , evidence for <i>B bavariensis</i> , <i>B bissettii</i> , <i>B spielmanii</i> , <i>B valaisiana</i> , <i>B lucitaniae</i>	7 proven pathogenic. 21 species in total	Fatigue, malaise, headache, radicular pain, cervical/lumbar pain, arthralgias, myalgias, memory/concentration disturbance, paresthesia, dizziness, nausea, muscle pain, headache, insomnia, blurred vision etc .

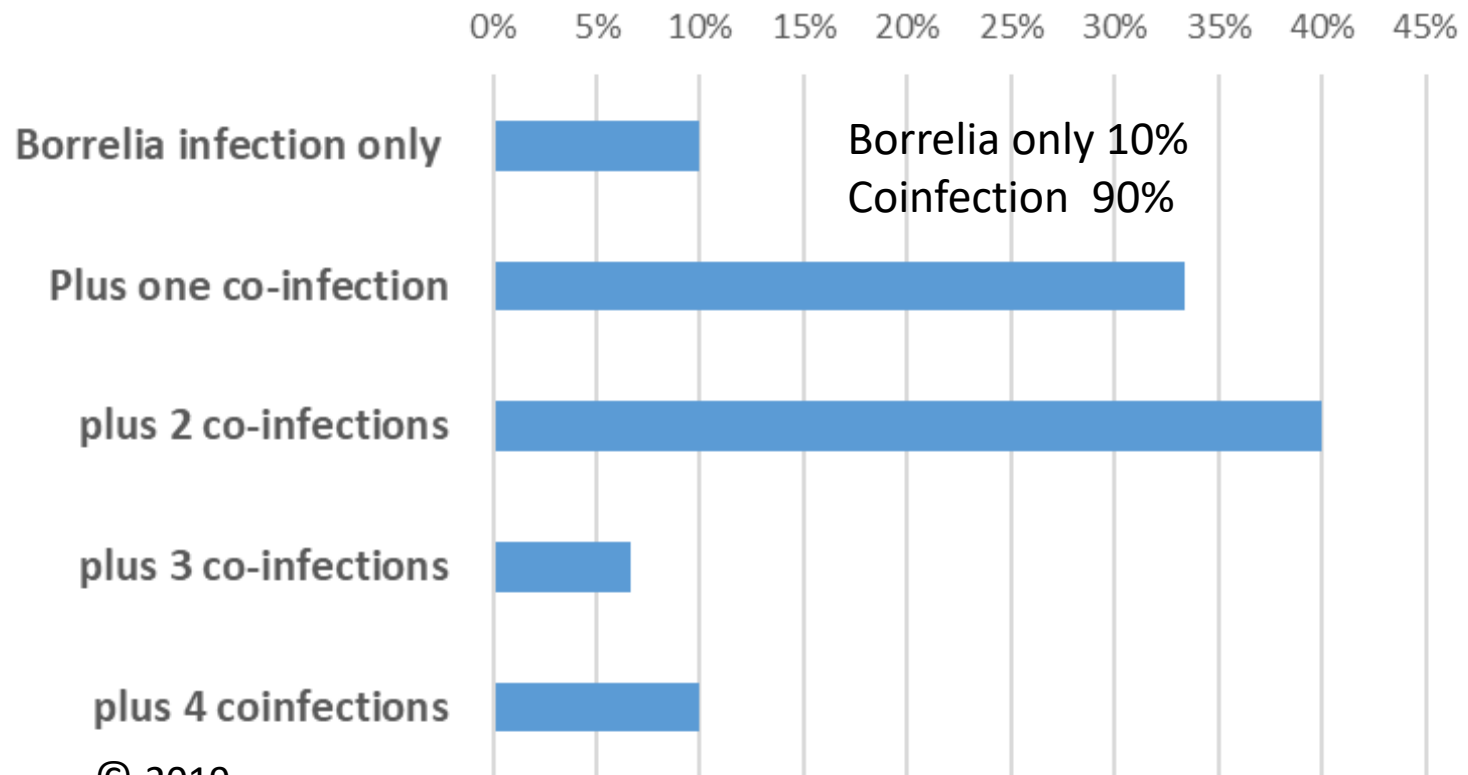
Human Tick-borne bacteria pathogens (Continued)

Disease	Pathogens	Number of species	Symptoms
Mycoplasmosis	<i>Mycoplasma pneumoniae, M. hominis</i>	17	Chest pain, chills, cough, excessive sweating, fever, headache, sore throat.
Q fever	<i>Coxiella burnetii</i>	1	High fever, chills/sweats, cough, chest pain, headache, clay-colored stools, diarrhea, nausea.
Relapsing fever	<i>Borrelia recurrentis, B. hermsii, B. duttonii, B. miyamotoi, B. lonestari? B. texasensis?</i>	28	Recurring, fever, headache, muscle pain, joint pain, nausea.
typhus, Rocky Mountain Spotted fever, rickettsialpox, Boutonneuse fever et al.	<i>Rickettsia rickettsii, R. conorii, R. aakari, R. parkeri, R. helvetica, R. phillipi, R. prowalzekii, R. typhi, R. raoulti, R. slovaca, Can R. amblyommii,</i>	>20	Rocky mountain spotted fever. High fever, chills, sever headache, nausea and vomiting, restlessness and insomnia.
tularemia,	<i>Francisella tularensis,</i>	1	Skin ulcer at tick bite, swollen lymph nodes, sever headaches, fever, chills, fatigue.
neoehrlichiosis	Candidatus <i>Neohrlichia mikurensis</i>	1	high intermittent fever, malaise, anemia, unconsciousness, thrombosis.
Number of diseases: 35 listed, total unknown.	All potential local and/or overseas travel risks	More than 120 bacterial species plus viruses and parasites	

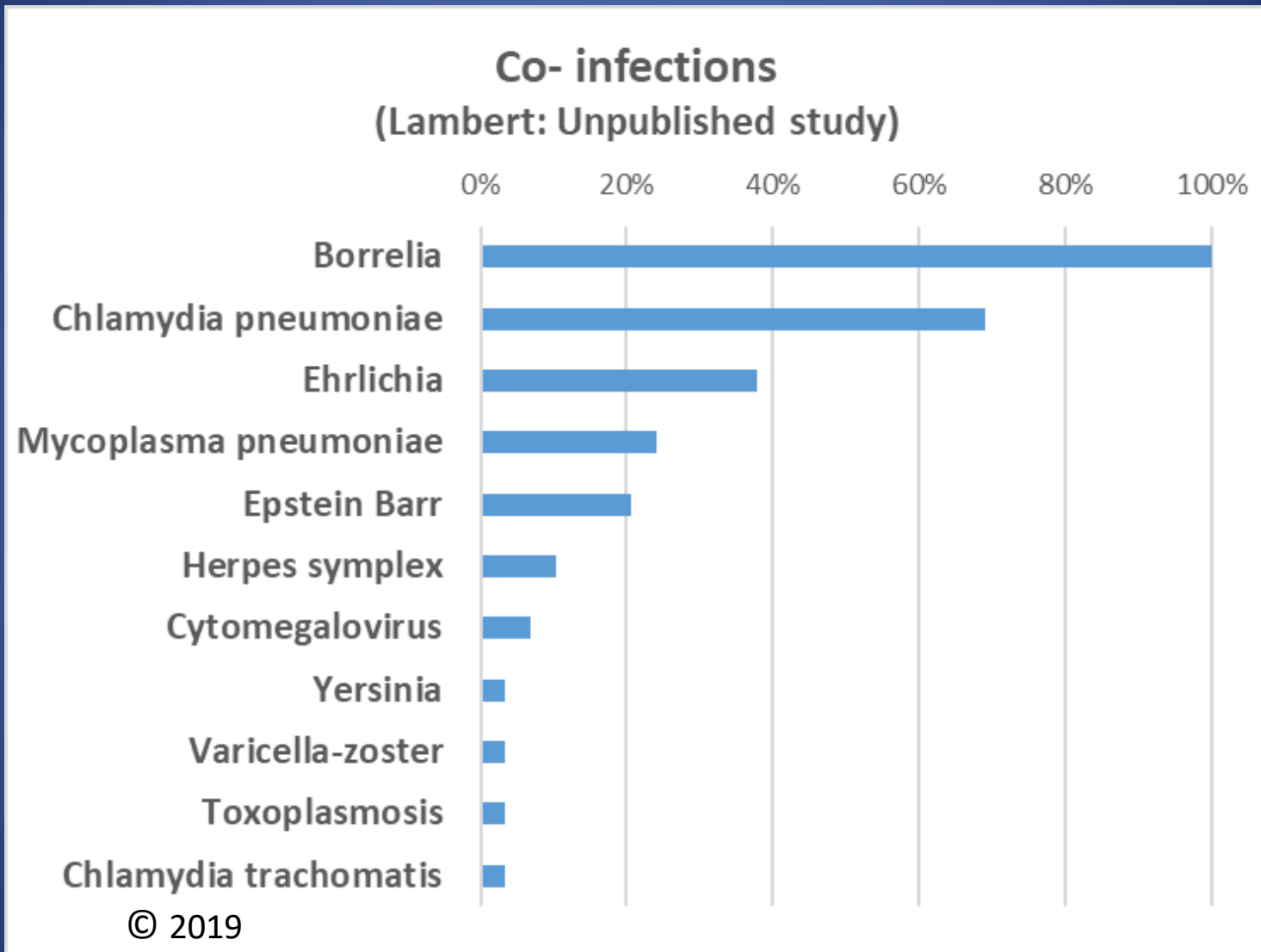
Human Tick-borne parasite/viral pathogens

Named Diseases	Pathogens	Number of species identified	Symptoms
Babesiosis	<i>Babesia microti</i> , <i>B divergens</i> <i>most common.</i>	>20	Fever, headache, body ache, loss of appetite, nausea,
Colorado tick fever	<i>Coltivirus</i>	4	Fever, chills, severe headache, light sensitivity, muscle aches, skin tenderness, loss of appetite, nausea.
Crimean-Congo hemorrhagic fever, Heartland virus, Bahnja virus, California encephalitis, Hantavirus, Rift Valley fever,	<i>Bunyavirus</i>	Many. More than 300 in this family	Crimean-Congo hemorrhagic fever: flu-like, hemorrhage, mood instability, agitation, confusion petechia, nosebleeds, vomiting etc.
Mycoplasmosis	<i>Mycoplasma pneumoniae</i> , <i>M. hominis</i>	17	Chest pain, chills, cough, excessive sweating, fever, headache, sore throat.
Tick-borne encephalitis, Louping Ill, Powassan virus	<i>Flavivirus</i>	12	TBE sudden fever, nausea/vomiting, stiff neck, headache, confusion, drowsiness, disorientation, seizures, sensitivity to light, inability to speak.
Tibeč, Lipovnik & Kemerovo virus infections	<i>Orbivirus</i>	3	
Uukuniemi virus		1	Antibodies isolate from humans
Number of diseases: 15 listed, total unknown.	All potential local and overseas travel risks	Hundreds?	

Probability of Co-infections data from different test panels (Lambert: Unpublished data)



© 2019



UK Testing

NICE require a positive two-tier test
A positive/equivocal ELISA
With a positive Immunoblot
At a UKAS accredited lab

Two-tier test

Based on independent test sensitivity and specificity this method can generate more than 500 times more false negative results when compared to HIV testing.

Cook MJ, Puri BK. Application of Bayesian decision-making to laboratory testing for Lyme disease and comparison with testing for HIV. *Int J Gen Med.* 2017;10: 113–123. Available:
https://www.dovepress.com/articles.php?article_id=32303

Errors encountered in microbiology laboratory testing

- Sample shipping, storage
 - Normally, human serum can be stored up to 5 days at 2 - 8°C.
- Use of inappropriate/unvalidated tests
 - Test for serum used with CSF
- Process modification
 - Incubation time changed from 30 minutes to 60 minutes
 - Calibration and recording charts not used.
- Modified interpretation
 - Equivocal result called negative
- Quality Control Failures
 - Smear/stained strips were not rejected
 - Missing control bands ignored
 - Evidence of misprocessing ignored

Summary/Conclusions

The infection

Borrelia travels with company. Many co-infections (90%)

Persisters form refractory to antibiotics.

Multi-systemic multitude of relapsing remitting symptoms

Testing

- Commercial tests used in the UK have low sensitivity
- Unknown sensitivity for many pathogenic species.
- The two-tier test generates up to 560 times more false negatives than HIV testing.

Laboratory practice

- Quality management: ISO 15189 accreditation
- Evidence that testing in Germany and USA is superior
- Lab results support but should not rule diagnosis (NICE issue)