

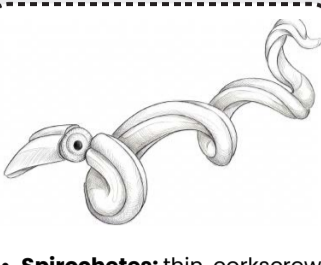
LYME DISEASE



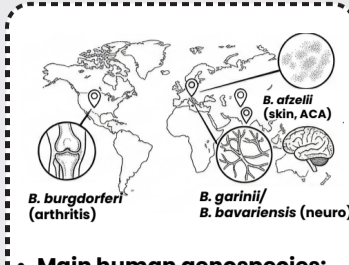
1. What Lyme borreliosis is

Tick-borne **bacterial disease** caused by *Borrelia burgdorferi sensu lato*. It is transmitted by infected *Ixodes* ticks (blacklegged / sheep / taiga ticks) and disease typically starts with **erythema migrans** at bite site, and may spread to skin, joints, nervous system, heart. Most patients are cured with standard antibiotics; some have prolonged, mainly subjective, symptoms.

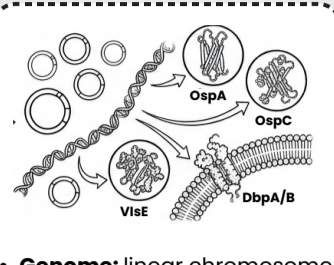
2. Microbiology



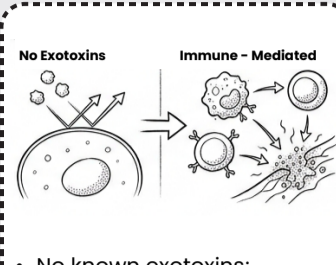
• **Spirochetes:** thin, corkscrew shaped bacteria with periplasmic flagella.



• **Main human genospecies:**
B. burgdorferi (USA, arthritis),
B. afzelii (skin, ACA),
B. garinii/B. bavariensis (neuro).



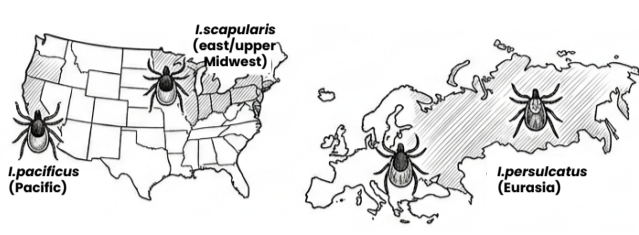
• **Genome:** linear chromosome + multiple plasmids encoding outer surface lipoproteins (OspA, OspC, VlsE, DbpA/B) for adhesion, tissue tropism, immune evasion.



• No known exotoxins; disease largely **immune mediated**.

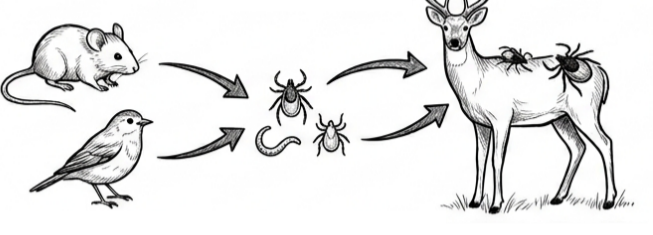
3. Reservoirs, transmission, vector biology

• Vectors:



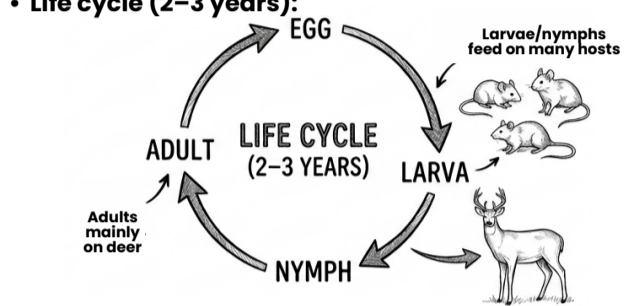
• USA: *I. scapularis* (east/upper Midwest), *I. pacificus* (Pacific).
 • Europe: *I. ricinus*; Eurasia: *I. persulcatus*.

• Reservoirs:



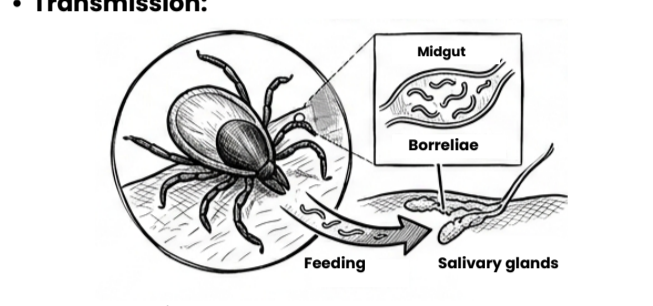
• Small mammals and songbirds; deer are key for adult ticks but not reservoirs.

• Life cycle (2–3 years):



• Egg → larva → nymph → adult; larvae and nymphs feed on many hosts, adults mainly on deer.

• Transmission:



• *I. scapularis*: usually >24 h attachment needed.
 • *I. ricinus*: transmission can occur in <24 h.

4. Epidemiology

North America:

• Foci: northeastern, mid Atlantic, upper Midwest USA; parts of Canada.

• ~90,000 reported U.S. cases (2023)
 • ~476,000 treated annually.

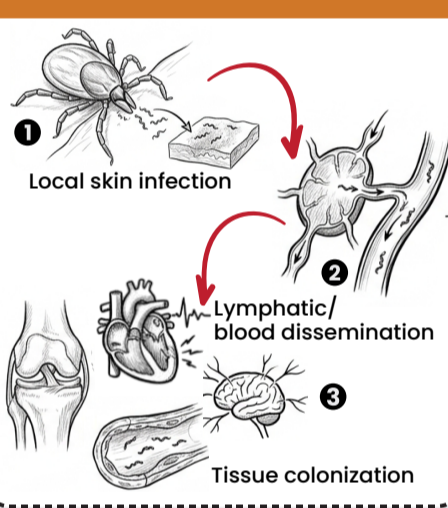
Europe:

Asia: Limited data

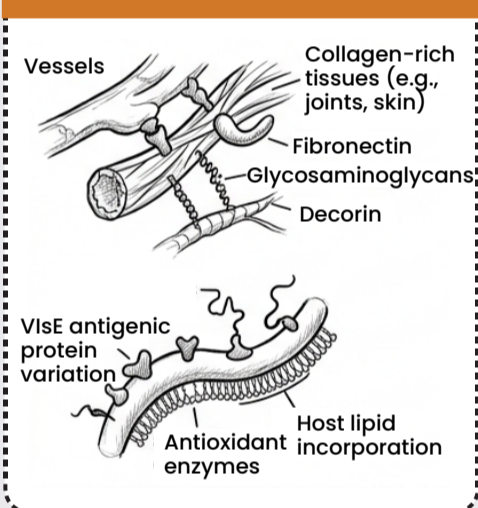
Typical pattern:

5. Mechanisms and pathophysiology

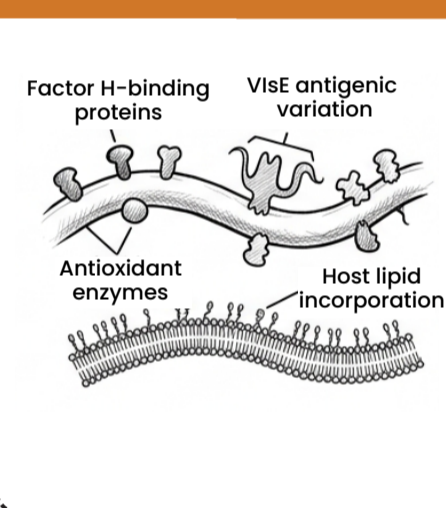
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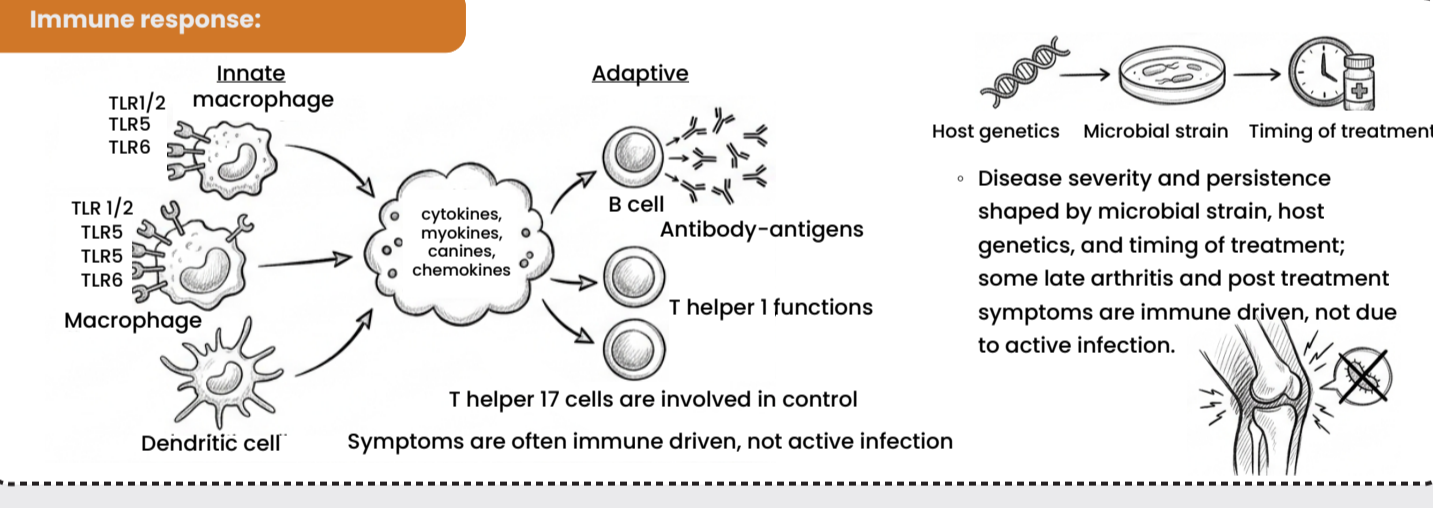
Adhesion/tropism:



Immune evasion:



Immune response:



6. Clinical phenotypes and complications

Early localized (erythema migrans):

• ≥80% of patients; expanding red patch 7–14 days after the bite, with or without systemic symptoms (fatigue, headache, myalgias, low fever).
 • Multiple lesions = early

Early disseminated:

• **Borrelial lymphocytoma** (mainly Europe, *B. afzelii*).
 • **Neuroborreliosis:** meningitis, facial palsy, radiculitis; Bannwarth's syndrome in Europe.
 • **Carditis:** fluctuating AV block ± myocarditis; can be life threatening.

Late disease:

• **Lyme arthritis** (common in USA, *B. burgdorferi*): intermittent/persistent mono/oligoarthritis, often knee; can be life-threatening is immune mediated.
 • **Acrodermatitis chronica atrophicans** (Europe, *B. afzelii*): distal discoloration and atrophy, neuropathy.
 • **Rare late encephalitis/myelitis.**

Regional differences:

• USA: more systemic early EM, arthritis frequent; ACA and lymphocytoma rare.
 • Europe: more cutaneous (lymphocytoma, ACA) and neuroborreliosis; arthritis less frequent.

• Case fatality is very low; severe diseases and death are mainly due to severe carditis; some residual deficits or persistent subjective symptoms may occur.

7. Therapy

Early localized EM:

• Doxycycline 10 days (adults/older children) or amoxicillin/ceftriaxone then oral; total 14–21 days; paracetamol as needed.

Neuroborreliosis:

• Oral doxycycline 14–21 days or IV ceftriaxone; paracetamol as needed; IV ceftriaxone 14–28 days.

Carditis:

• Hospitalization if high grade block; IV ceftriaxone then oral; total 14–21 days; paracetamol as needed.

Arthritis:

• 28 days oral doxycycline/amoxicillin/cefuroxime; if failure, 14–28 days IV ceftriaxone; persistent synovitis immunomodulatory therapy, not more antibiotics.

Special groups:

• **Pregnancy/young children:** prefer β lactams, limit doxycycline.
 • Immunocompromised same: regimens, closer follow-up.

8. Prevention

Personal protection:

• Avoid tick habitats; repellents; long, tucked clothing; shower and tick check after exposure; prompt tick removal.

Environmental: Limited effect

• Habitat management, acaricides, deer control in high risk areas.

Post-exposure prophylaxis:

• USA: single 200 mg doxycycline within 72 hours of a high-risk *I. scapularis* bite in selected situations; many European guidelines prefer observation.

Vaccines:

• Past Human OspA vaccine effective but withdrawn.
 • Multivalent OspA vaccines (for example VLA15) and OspA monoclonal antibodies >70% effective in phase 3 study; canine OspA vaccines already in use.

References

Poland GA. Vaccines against Lyme disease: what happened and what lessons can we learn? Clin Infect Dis. 2011;52 (suppl 3):S253–S258. doi:10.1093/cid/ciq116