**General**

- Anaerobic or microaerophilic
- Helical, tightly coiled
- Hard to cultivate in the laboratory
- The majority of *Treponema* species are normal flora in the oral cavities, genital tract, or rumen of animals
- A few species are pathogenic
- Motile: periplasmic flagella

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**Treponema pallidum ssp. pallidum**

- Humans are the only known natural host
  - Cannot culture the organism with artificial media in the lab
  - An important human pathogen causing syphilis
    - 12 million new cases of syphilis per year (WHO, 1999)
- Highly invasive
  - Can invade directly through mucous membranes or abraded skin
- Transmission
  - Venereal
  - Can be transmitted to the lips via kissing
  - Can be transmitted to physicians or pathologists who do not take adequate precautions
  - Transplacental transmission is also common

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**Treponema & Borrelia**

- Extremely low density of surface-exposed transmembrane proteins
  - The bacterial surface is antigenically inert
  - Promote evasion of the immune system

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**Treponema pallidum ssp. pallidum**: Disease stages

- **Primary stage**
  - The development of a chancre at the site of entry of the organism
  - These lesions are typically single
  - Not painful
  - Have a raised border
  - Reddish in color
  - Large numbers of organisms can be shed from these lesions
  - 100% cure rate if treated at this stage
  - The organisms move from mucous membranes to the bloodstream and develop the secondary syphilis

- **Secondary stage**
  - 2-10 weeks after the development of the primary lesion
  - This stage is characterized by fever, sore throat, headache and rash: The rash can occur on the palms and soles
  - Without treatment → enters a period of latent disease
  - Congenital syphilis
    - Most likely to occur when the infection is active during the primary and secondary stages
    - Occurs in about 2% of infected pregnant females
    - The organism becomes widely disseminated in the fetus → cause abortions or severe physical and mental deformities

- **Tertiary stage**
  - Characterized by the formation of localized lesions of the skin called “gummas”
  - Develops 3-10 years after the secondary stage
  - The organism invades cardiac muscle, musculoskeletal systems and the central nervous system
    - Neurosyphilis may mimic other neurologic diseases
    - Cardiovascular syphilis may occur 10 to 40 years following primary disease
Treponema pallidum ssp. pallidum

- Can not culture the organism in the lab
- Direct examination of lesion materials
- Darkfield microscopy
- Fluorescent antibody test

- **VDRL (Venereal Disease Research Laboratory) Test**
  - Looking for anti-cardiolipin Ab not anti-treponemal Ab
  - Cardiolipin: a phospholipid, serologically active in the presence of lecithin
- It is not known whether cardiolipin is from *T. pallidum* or the host

- **Treatment**: Penicillin is effective, if allergic, tetracycline

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Treponema paraluis-cuniculi

- The cause of "rabbit syphilis"
  - The lesions are usually confined to the genital region, but the lips and eyelids may be involved
  - Occur in both male and female

- **Transmission**
  - Venereal
  - Not transmissible to humans or other domestic animals

- **Diagnosis**
  - Clinical signs
  - VDRL test
  - Darkfield microscopy

- **Treatment**
  - Penicillin
  - Necessary to treat the whole rabbits to eradicate from a herd

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Treponema brennaborense

- Isolated from cattle with "bovine digital dermatitis"

- **Bovine digital dermatitis**
  - (Papillomatous digital dermatitis, Hairy footwart)
  - An acute or chronic inflammatory disease in interdigital space of the bovine foot
  - Loss of keratin, pain and swelling → lameness
  - Highly contagious; spread rapidly within affected herds
  - At slaughter in the US, 29% of the dairy cattle had lesions of digital dermatitis, but the incidence in beef cattle appears to be minimal

- Its pathogenesis is unknown

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Treponema brennaborense

- **Diagnosis**
  - Observation of typical lesions common in interdigital space
  - Detection of spirochetes with FA

- **Treatment**
  - Penicillin and ceftiofur
  - Topical dressing with soluble oxytetracycline
  - Footbath containing topical applications or zinc sulfate
  - Large, chronic foot warts → Surgical removal

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http://www.coppersulfatecrystals.com/footbath.html
Treponema in other animals


Identification of Spirochetes Associated with Contagious Ovine Digital Dermatitis

G. Sayers,† P. X. Manara,† N. J. Evans,† L. O'Grady,† M. L. Dobben,† S. D. Carter,† and J. E. Nally†

Fermentum Science Centre, CEF, School of Veterinary, Food Science and Tropical Medicine, and VES Centre, Institute of
Bovine and Bovine Research, University College Dublin, Belfield, Dublin, and Department of Veterinary Pathology,
Faculty of Veterinary Science, University of Liverpool, Liverpool, United Kingdom

● May cause digital dermatitis in other animals too?
Treponema phagedenis-like
Treponema medium-like
Treponema vincentii-like

Infected hoof

Treponema

T. pallidum ssp. pallidum
T. paraluis-cuniculli
T. brennaborens

Syphilis
Digital Dermatitis

Treponema & Borrelia

General

● Obligate parasite in a variety of vertebrate hosts
● All of the species are transmitted by ticks and lice
● Morphology
  ➢ Longer and wider than other spirochetes
  ➢ Has fewer coils
  ➢ Motile by periplasmic flagella

B. burgodeferi in the ear of mouse
**B. burgdorferi**

- Causes Lyme disease (Lyme borreliosis)

**Transmission**
- Transmitted by several tick species (mainly *Ixodes* species)
- The tick feed on an infected animal
  - Pass the organism to ticks
  - Transmit the organism to any hosts that it feeds on, including deer, humans, dogs, horses, and cattle

**B. burgdorferi: Ticks**

- [Blacklegged (Deer) tick](http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php)
- [Blacklegged tick: nymph](http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php)
- [Blackleg tick: female adult](http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php)

**B. burgdorferi: Transmission**

- First identified in Lyme County, Connecticut, US, in 1975
- Occurs primarily in summer
- Characterized initially by a distinctive skin lesion “erythema migrans” in 50% of adults and 90% of children
- Symptoms (such as fever, headache, joint pain, etc.) occur as long as 1 month after the tick bite → can delay diagnosis
- Can cause arthritis, neuritis, and cardiac complications, it can be fatal, but fatalities are low

**B. burgdorferi: Lyme disease**

- Treatment: tetracycline and penicillin
- Vaccines: Available for dogs, - The only human vaccine LYMErix (GlaxoSmithKline) was quietly pulled off the market in 2002
**B. burgdorferi:**

**Veterinary significance**

- *B. burgdorferi* causes a tick-transmitted inflammatory joint disease of dogs and cattle, and possibly horses

**In dogs**

- Lameness, fever, lethargy, with or without swollen lymph nodes
- Does not develop erythema migrans
- Renal, cardiac, and neurologic forms
- Generally fatal

**Diagnosis:**

- Clinical signs: swollen and painful joints and fever
- ELISA, PCR

**Treatment:** Tetracycline and penicillin are effective

**In endemic areas, young dogs should be “vaccinated” before natural exposure to ticks**

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**B. anserina**

- Cause avian spirochetosis
  - Chickens, ducks, turkeys, geese primarily in young birds
  - Worldwide distribution, but not very common in the US

**Disease**

- Acute septicemia with fever, diarrhea, drowsiness, emaciation
- Enlargement of spleen
- Usually starts with green or yellow diarrhea
- Young birds are more severely affected
- Mortality: 33-77%

**Transmission:** Via bites of ticks, mainly *Argas persicus* (fowl tick)

**Diagnosis:** Can be cultivated in chicken embryos
  - Direct examination by darkfield microscopy

**Treatment:** Penicillin, tetracycline, kanamycin and streptomycin

**Prevention:** Tick control

**Vaccination:** Bacterins work successfully

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**B. theileri**

- Cause bovine borreliosis: septicemia/fever
- Often seen in Australia and Africa
- Caused by “lone star tick”

**Species & Disease**

<table>
<thead>
<tr>
<th>Species</th>
<th>Vector</th>
<th>Host</th>
<th>Clinical conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>B. burgdorferi</em></td>
<td>Blacklegged tick</td>
<td>Dogs</td>
<td>Arthritic, renal, cardiac and neurologic disease</td>
</tr>
<tr>
<td><em>B. anserina</em></td>
<td>Fowl tick</td>
<td>Birds</td>
<td>Avian spirochetosis, fever, weight loss and high mortality in young birds</td>
</tr>
<tr>
<td><em>B. theileri</em></td>
<td>Lone star tick &amp; many tick spp.</td>
<td>Cattle, sheep, horses</td>
<td>Bovine borreliosis, Mild, febrile disease with anemia</td>
</tr>
</tbody>
</table>

The female is distinguished from any other tick by her white dot in the center of her back.