

SPIROCHAETES

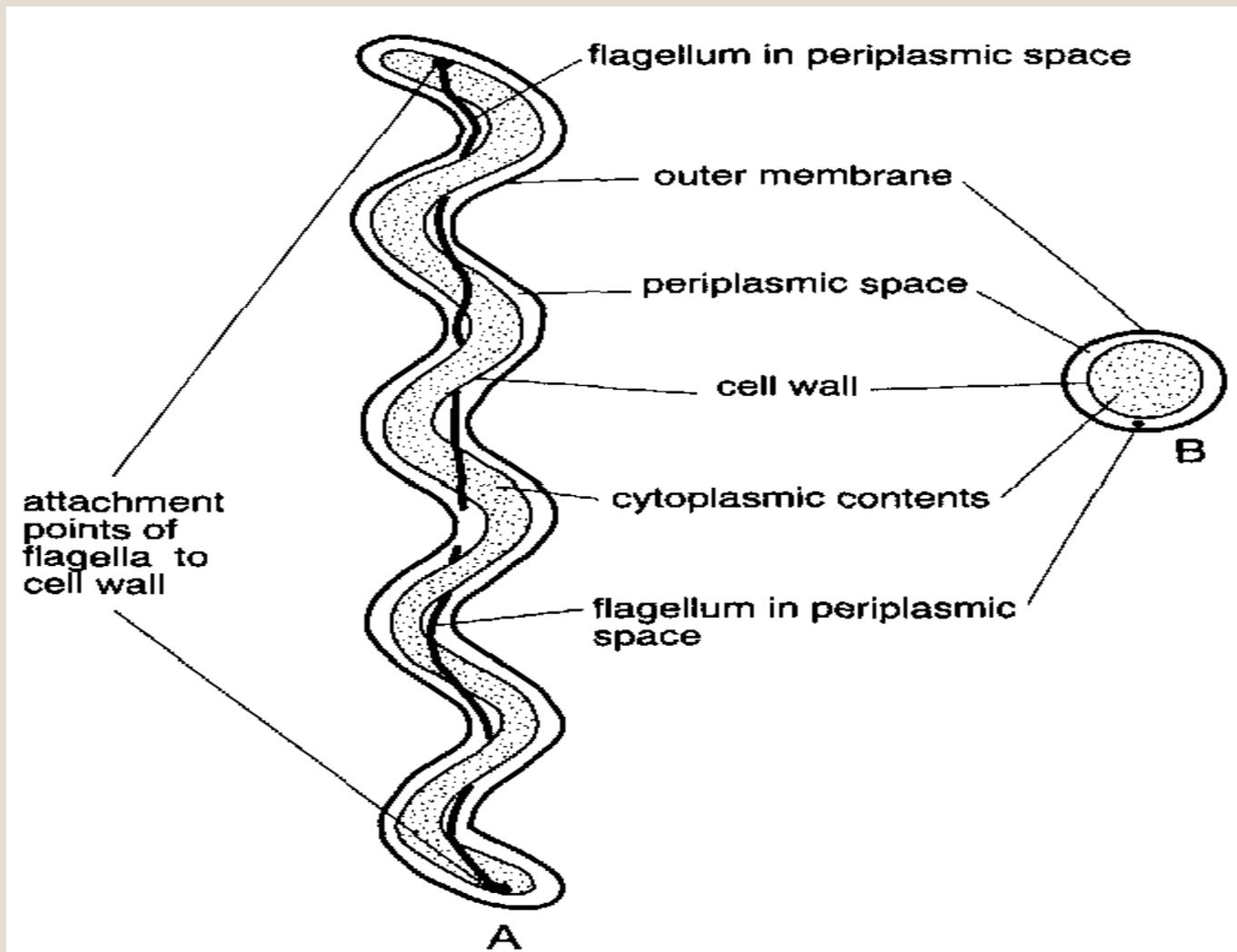
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General characteristics

- They are spiral shaped bacteria
- Motile by flagella (two in number) present in periplasmic space
- Being present in periplasmic space, these flagella are called endoflagella
- Can be grown on special artificial media
- Cytochemically, they are gram negative



Classification

Order

Family

Genus

Spirochaetales

Leptospiraceae

Leptospira

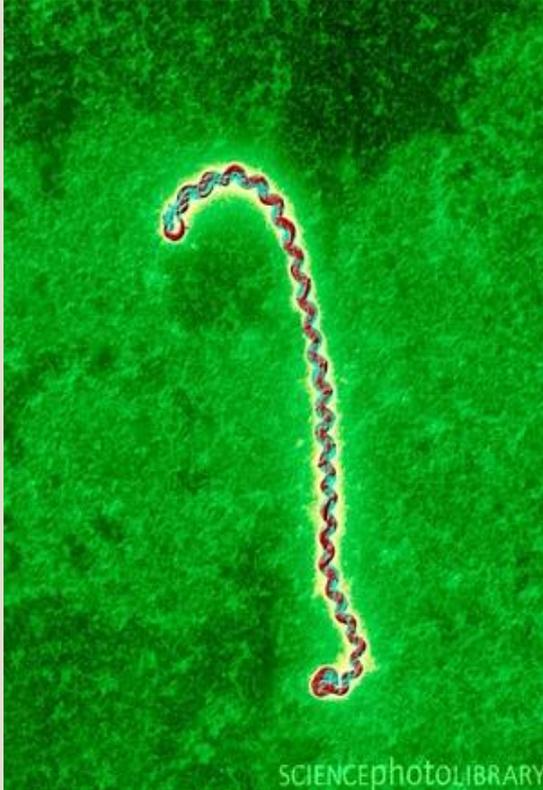
Spirochaetaceae

Borrelia

*Brachyspira/
Serpulina*

Treponema

Leptospira



- Leptospires are motile helical bacteria (0.1 x 6 to 12 μm) with hook-shaped ends
- They do not stain well with common dyes
- Usually visualized using dark-field microscopy
- Silver impregnation and immunological staining techniques are used to demonstrate leptospires in tissues.

Leptospira

- Fragile organism
- Survive in ponds, rivers, surface waters etc.
- Formerly, two species were known:
 - *L. interrogans* (*pathogenic*), and
 - *L. biflexa* (*saprophytes*)
- Currently, seven species of leptospira is known
- More than 250 serovars in 23 serogroups
- Many of serovar are host adapted

Maintenance and Accidental hosts

Maintenance host

- Maintenance hosts are highly susceptible
- Disease is frequently mild or subclinical
- Prolonged excretion of leptospire in urine
- Severe form of disease is seen in young animals

Accidental hosts

- Accidental hosts exhibit low susceptibility
- Disease is of serious nature
- Poor transmission of leptospire to other animals

Serovar	Maintenance hosts	Incidental hosts
<i>bratislava</i>	Pigs, hedgehogs	Horses, dogs
<i>canicola</i>	Dogs	Pigs, cattle
<i>grippotyphosa</i>	Rodents	Cattle, pigs, horses, dogs
<i>hardjo</i>	Cattle, (sheep occasionally)	Humans
<i>icterohaemorrhagiae</i>	Brown rat	Domestic animals, humans
<i>pomona</i>	Pigs, cattle	Sheep, horses, dogs

Pathogenesis

- Invade tissues through moist, softened skin or through mucous membranes, conjunctiva
- Motility may aid tissue invasion
- Haematogenous spread is observed
- Upon appearance of antibodies after 10 days, they are cleared from circulation
- Remain present in Renal tubules, uterus, eye or meninges

Acute leptospirosis



- In susceptible animals,
 - damage to red cell membranes
 - endothelial cells
 - hepatocellular injury
 - haemolytic anaemia,
 - jaundice
 - haemoglobinuria and haemorrhage

Leptospirosis in cattle and sheep

- Cattle are maintenance hosts for
 - *L. borgpetersenii* serovar *hardjo* and
 - *L. interrogans* serovar *hardjo*
- Susceptible heifers, infected for the first time at calving, may develop ***acute disease with pyrexia and agalactia***
- Infection may also result in ***abortions and stillbirths***
- Infection with serovar *hardjo* in sheep- can cause ***abortions and agalactia.***

Infection in cattle and sheep



- Infection with *serovars pomona, grippotyphosa, and icterohaemorrhagiae* can cause serious disease, (particularly in calves and lambs)
- Infection is usually accompanied by ***pyrexia, haemoglobinuria, jaundice and anorexia.***
- Extensive ***renal damage with resultant uraemia*** often precedes death.
- serovar pomona which is an important cause of ***bovine abortion*** in some countries

Infection in horse

- Serovar bratislava: abortions and stillbirths in horses
- ***Serovar pomona*** - abortion in mares and renal disease in young horses
- chronic leptospirosis- anterior uveitis (periodic ophthalmia, 'moon blindness')
- Cross-reactions between leptospiral antigens and proteins from the cornea and lens



Infection in Pig

- Usually affected with rodent adapted serovars -icterohaemorrhagiae and copenhagenii
- These serovars cause serious, sometimes fatal, disease in young pigs
- The principal host-adapted serovar is pomona
- Reproductive failure including abortions and stillbirths is seen



Infection in Dog

- Important serovars associated with leptospirosis in dogs are canicola and icterohaemorrhagiae.
- serovars grippityphosa and pomona emerging as important canine pathogens
- ***Serovar canicola***, which is host-adapted for dogs, ***causes severe renal disease in pups***
- In surviving dogs, ***a chronic uraemic syndrome*** may develop
- Infections caused ***by icterohaemorrhagiae are characterized by acute haemorrhagic disease or subacute hepatic and renal failure***

Leptospirosis in dog

- The severity is variable, depending on several factors, including
 - age and immune reaction of the host, and
 - the virulence of the infecting serovar
- The incubation period is approximately five to 15 days



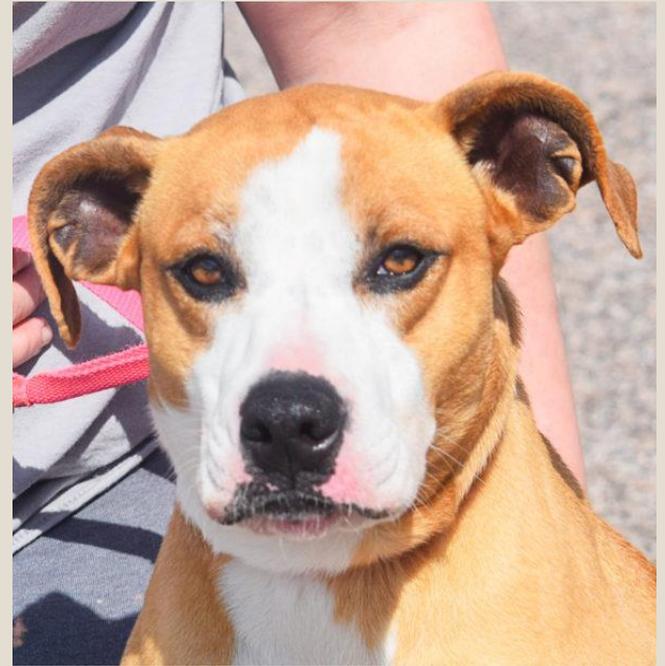
Leptospirosis in dog

- Peracute, acute and subacute/chronic manifestations of the disease are observed
- In peracute cases, sudden death is seen
- Acute cases – ch/by pyrexia, shivering, muscle weakness, vomiting, dehydration and shock, and tachypnoea
- Hepatic and renal failure do not have time to develop.



Leptospirosis in dog

- Subacute leptospirosis is characterised by
 - Fever, Anorexia, Vomiting,
 - Dehydration and increased thirst
 - Lethargy, abdominal pain,
 - muscle pains and/or diarrhoea
 - causing hepatic encephalopathy, and icterus
- Coughing and dyspnoea may also occur
- Some dogs develop conjunctivitis, rhinitis and tonsillitis
- Polyuria and polydipsia can develop - deterioration of renal function and/or liver insufficiency.



Diagnosis

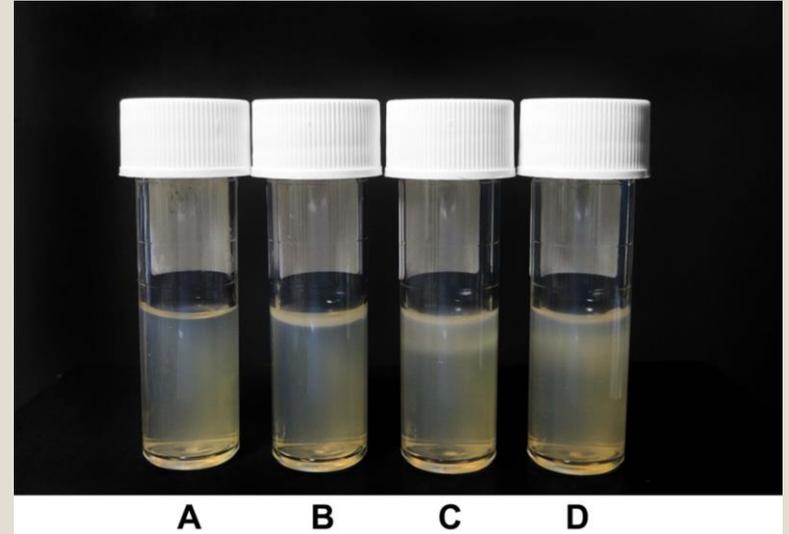
- Clinical signs and symptoms
- History exposure to contaminated urine
- Visualised in fresh urine by dark-field microscopy
- Fluorescent antibody procedures (FAT) are often used for the demonstration of leptospire in tissues.
Suitable tissues ***include kidney, liver and lung***
- Silver impregnation techniques can also be used for demonstration of leptospire
- PCR

Microscopic agglutination test (MAT)

- The standard serological reference test, is microscopic agglutination test (MAT)
- It involves mixing live culture growing with equal volumes of doubling dilutions of test serum.
- Titres in excess of **1:400** or a four-fold rise in the titre in paired
- The MAT is a serogroup-specific assay and cannot be relied upon to detect the infecting serovar
- The MAT is read by dark field microscopy -Both IgM and IgG antibodies
- Titers following acute infection may be extremely high ($\geq 25,600$)
- A number of ELISA tests have been developed

Isolation of leptospira

- Leptospire may be isolated from
 - Blood - first seven to ten days of infection
 - Urine - two weeks after initial infection
- In liquid medium or by animal inoculation
- Slow-growing serovars such as hardjo may require incubation for six months in liquid media at 30°C
- **EMJH (Ellinghausen, McCullough, Johnson and Harris)** medium based on 1% bovine serum albumin and Tween 80

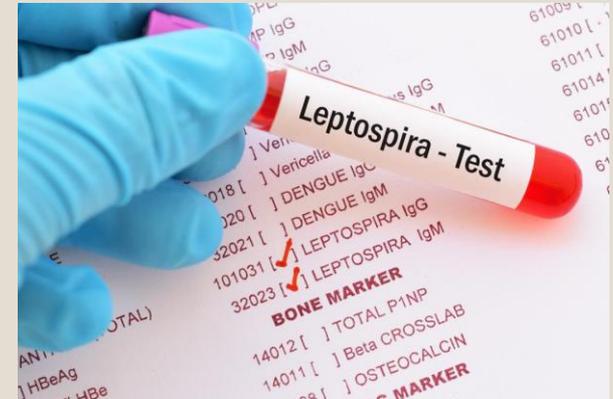


Human Leptospirosis

- Occupational hazard and Human is regarded as Accidental host
- Veterinarians, Abattoir workers, Livestock Farmers, Paddy field workers, persons involved in sewage / drainage cleaning
- It's a potentially fatal zoonosis
- Mainly endemic in tropical areas with heavy rainfall and flooding
- Portals of entry include cuts and abrasions or mucous membranes such as the conjunctival, oral, or genital surfaces
- Infection is mostly acquired through water contaminated with infected Urine
- Brown rat is important source of human infections.

Human Leptospirosis

- ***Acute febrile illness characterized by sudden onset of fever, myalgia,, vomition, Jaundice and headache***
- Conjunctival suffusion (dilatation of conjunctival vessels without purulent exudate)
- Subconjunctival hemorrhages and icterus
- Hepato-cellular damage, Renal dysfunction
- Multisystem organ failure
- ***Severe pulmonary hemorrhage syndrome*** (SPHS) due to extensive alveolar hemorrhage has a fatality rate of >50 %.
- Fatality is more in patients with age 60 or more.



Human Leptospirosis

- The combination of jaundice and renal failure, known as **Weil's disease**,
- **Weil's disease** is a severe form of leptospirosis.
- **doxycycline** or penicillin, should be given early in the course of the disease
- Pre-exposure - doxycycline (200 mg orally once per week)
- Post exposure - doxycycline 100 mg orally twice per day
- Intravenous antibiotics may be required for persons with more severe symptoms.