ORDER : RICKETTSIALES

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Order rickettsiales

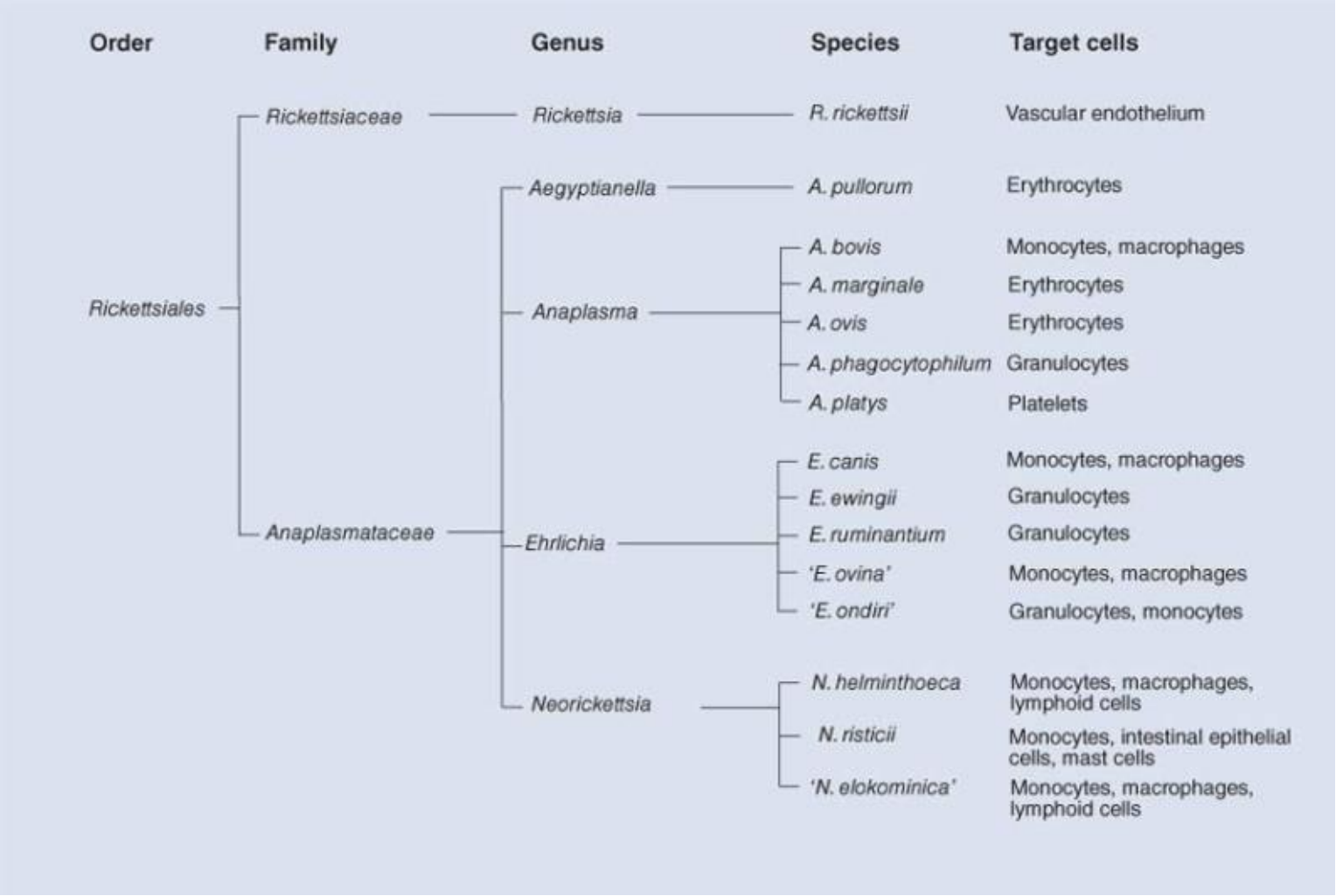
- It contains very small non motile pleomorphic Gram negative bacteria which replicate only in host cell.
- It is cultured in Yolk sac of embryonated egg or in cell culture
- The organisms are named after HT Rickets who contracted typhus fever and died of this.
- Transmission of rickettsial disease occur by bite of arthropod except one disease Q fever
- Q fever or Abattoir fever caused by Coxiella burnetti which is transmitted by ingestion and inhalation

- Coxiella organism can survive flash method of pasteurisation
- Rickettsial organism require a living system for growth except Bartonella quintana (previous name was Rochalimea quintana) which can grow on modified blood agar and cause of trench fever in human being
- The family anaplasmataceae do not have cell wall.
- Rickettsial organism stains poorly with aniline dyes
- Important staining methods are Giemsa, Leishman staining,Gimenez, castanada and Machiavello staining
- Host cell dependence for growth, poor affinity for basic dyes,, presence of invertebrate vector distingushes them from conventional bacteria and chlamydia

G: Rickettsia

- Genus rickettsia have rigid cell wall and cytoplasmic membrane similar to that of E. coli
- They are non capsulated, non motile aerobic organism and multiply by binary fission
- Organism also grow in mice, guinea pig and rabbit
- Inoculation on yolk sac or cell culture also used
- Optimum temperature of growth is 33-35^{o}C
- Some species like Rickettsia prowazekii and R. typhi produce lethal toxin harmful to mice

CLASSIFICATION



RICKETTSIA

- R. prowzekii transmitted by human body louse and the disease is called epidemic typhus
- Rikcettsia typhi/Rickettsia mooseri: endemic typhus or murine typhus transmitted by flea
- Rickettsia rickettsi: will cause rocky mountain spotted fever where ticks act as vector
- Rickettsial akari: rickettsial pox
- Rickettsia conorii: indian tick typhus

Pathogens of veterinary importance in Anaplasma

Pathogen	Hosts/Vectors	Disease	Geographical distribution
Aegyptianella pullorum	Poultry/Ticks	Aegyptianellosis	Africa, Asia, Mediterranean region
Anaplasma bovis	Cattle/Ticks	Bovine anaplasmosis	Africa, Middle East, Asia, South America
A. marginale	Ruminants/Ticks	Anaplasmosis	Tropical and subtropical regions
A. ovis	Sheep, goats/Ticks	Anaplasmosis	Asia, Africa, Europe, USA
A. phagocytophilum	Ruminants, horses, humans/Ticks	Tick-borne fever, equine and human granulocytic ehrlichiosis	Worldwide
A. platys	Dogs/Ticks suspected	Canine cyclic thrombocytopenia	Americas, Middle East, Mediterranean region
Ehrlichia canis	Dogs/Ticks	Canine monocytic ehrlichiosis	Tropical and subtropical regions
E. ewingii	Dogs/Ticks	Canine granulocytic ehrlichiosis	USA
E. ruminantium	Ruminants/Ticks	Heartwater	Sub-Saharan Africa, Caribbean islands
'E. ondiri'	Cattle/Ticks suspected	Bovine petechial fever	Highlands of East Africa
'E. ovina'	Sheep/Ticks	Ovine ehrlichiosis	Africa, Asia, Middle East
'Neorickettsia elokominica'	Dogs, bears, racoons/Flukes	Elokomin fluke fever	West coast of North America
N. helminthoeca	Dogs, bears/Flukes	Salmon poisoning disease	West coast of North America
N. risticii	Horses/Flukes	Potomac horse fever	North America, Europe

- Orientia: organism is Orientia tsutsugamushi (Rickettsia tsutsugamushi) transmitted by tick and the disease is called scrub typhus
- Target cells for Rickettsia and Orientia are vascular endothelial cells

Diagnosis of rickettsial infection

- Agglutination test called Weil Felix reaction
- Here patients serum is mixed with Proteus vulgaris serotype OX K, OX 2, and OX 19
- in positive cases there will be agglutination
- Other diagnostic test are CFT, ELISA and indirect HA and indirect immunodiffusion test

- Blood or tissue smears stained by the Giemsa technique can be used to demonstrate the morphology of members of the *Anaplasmataceae*. They occur as purplish blue, small, individual organisms, sometimes in clusters, or as morulae up to 4.0 µm in diameter
- Fluorescent antibody techniques can be used to identify *R. rickettsii* and specific members of the *Anaplasmataceae* in smears.
- Some organisms can be isolated in the yolk sac of embryonated eggs or in defined tissue culture cell lines.
- Molecular methods, such as nucleic acid probes and polymerase chain reaction techniques,
  including real-time PCR techniques, have been developed to detect members of the *Rickettsiales* in host tissues.
- In outbreaks of major diseases such as bovine anaplasmosis, susceptible domestic animals can be
  inoculated with infected blood or tissue in order to identify an organism or confirm a diagnosis.

Rocky mountain spotted fever

Etiology : Rickettsia rickettsii

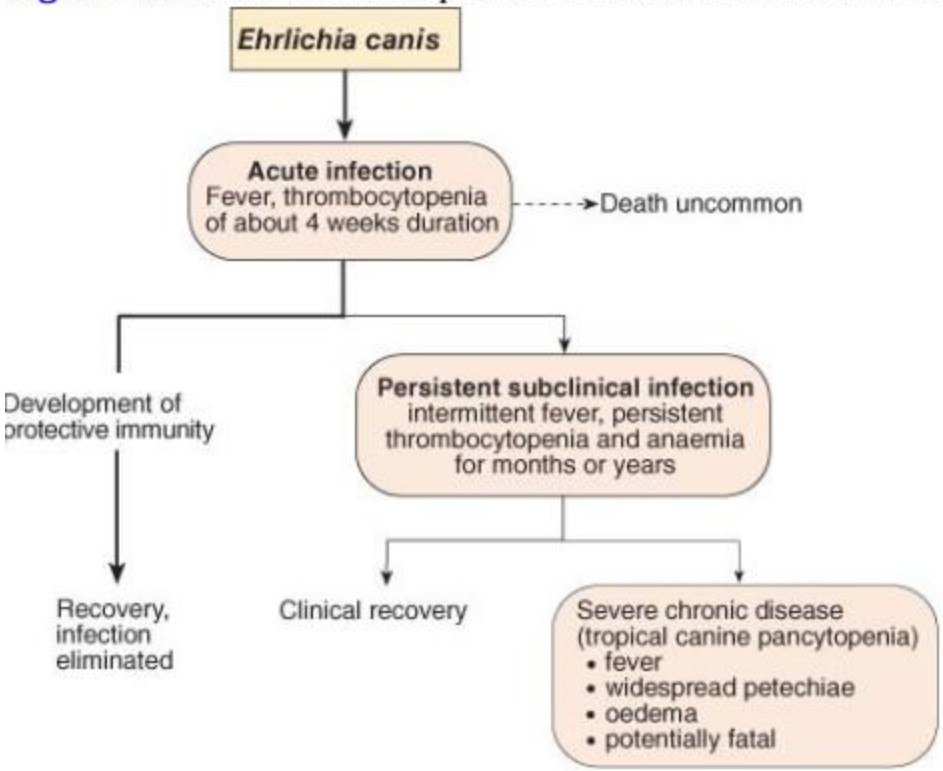
Vector : Dog tock (Rhipicephalus)

The organisms, which replicate in endothelial cells of infected dogs, produce vasculitis, increased vascular permeability and haemorrhage.

Canine monocytic Ehrlichiosis:Ehrlichia canis

- Host : dog
- Vector : *Rhipicephalus sanguineus*, the brown dog tick
- Disease is known as Canine Ehrlichiosis, Dog typhus,Tropical canine pancytopaenia
- Nairobi bleeding disease
- Clinical signs: progressed through subclinical acute and chronic phase
- Acute phase characterised by fever thrombocytopaenia, leucopaenia and anaemia
- Minority of dog later develop severe form of disease characterised by persistent bone marrow depression , heamorrhage , neurological disturbance, petechial haemorrhage oedema and emaciation

Figure 40.2 Possible consequences of infection with *Ehrlichia canis*.



Diagnosis

- Clinical symptoms and histological lesions
- Morulae of organism detected in mononuclear cells by Giemsa staining of buffy coat
- FAT to demonstrate organism in smears
- Supernatant of heparinised blood can be can be cultured in canine macrophage cell line
- Serum conversion can be demonstrated 3 weeks after infection by indirect immunoflourescence
- Treatment and control
- Doxycycline for 10 days, tetracyclin and cloramphaenicol effective
- Fluid replacement therapy and blood transfusion

Bovine petechialfever

- Ehrlichia ondiri
- Cattle host
- Vector : tick
- Clinical signs : Clinical signs include high fluctuating fever, depressed milk yield and widespread petechiation of visible mucous membranes.
- Oedema and petechiation of the conjunctiva produces ‘poached-egg’ eye, a feature typical of severe cases.
- Death often results from pulmonary oedema. Recovered animals, which become carriers, are resistant to reinfection for at least 2 years.

Heart water disease

- *Ehrlichia ruminantium*
- Tick belong to Amblyoma are main vector
- Organism replicate in reticuloendothelial cells especially macrophages and endothelial cells of capillaries of CNS
- Clinical signs: sudden onset of fever, neurological signs are common including chewing movement, twitching of eyelids, high stepping gait, circling and recumbency
- Death during convulsions in acute cases
- In sub acute cases lesions are hydropericardium, hydrothorax, pulmonary oedema and congestion, spleenomegaly, extensive mucosal and serosal damage

DIAGNOSIS

- Symptoms as nervous signs
- Post mortem lesions in endemic areas, provide presumptive diagnosis
- Squash preparation off brain tissue stained by Giemsa, so organism seen located close to nucleus
- Nucleic acid probes
- PCR
- Antibody detection by indirect immunofluorescence
- ELISA, western blot
- Treatment and control
- Tetracyclin administration during early phase
- Immunisation by inoculating blood from infected animal
- Tick control

Salmon poisoning

- Neorickettsia helminthoeca
- Host: dogs
- Vectors are fluke
- Dogs infected by ingestion of raw salmon containing fluke metacercariae.
- Then the organism attach to the blood following attachment of fluke to intestinal mucosa of host
- Replication of bacteria in typhoid tissue result in generalised lymphadenopathy
- Neorickettsia ristici: horses are host
- Flukes are suspected vector
- Disease called Potomac horse fever

Potomac horse

- Neorickettsia ristici: horses are host
- Flukes are suspected vector

Bovine anaplasmosis

- Anaplasma marginale: organism appear as purple dot in periphery of RBC
- Host cattle
- Vector Boophilus
- Also called gall sickness
- Important signs are inappetite , depression. decreased milk yield, marked anaemia, jaundice develop in absence of haemoglobunuria and weight loss
- Diagnosis:
- Clinical signs and haematological findings

- Geimsa stained blood smear contain densely stained bodies located near the periphary of RBC. Organism are most numerous at about 10 days after onset of fever when upto 50% of RBC affected
- Identification of organism in blood smear by immunoflourescence
- Nucleic acid probes
- PCR
- Serological tests as CFT, Card agglutination test, ELISA, Dot ELSA for detection of antibodies in serum

Tick borne fever

- Anaplasma phagocytophila: tick borne fever or grazing fever
- Anaplasma platys Dogs host and ticks suspected vector
- Disease : canine cyclic thrombocytopenia
- Aegyptianella pullorum : affect poultry and wild birds
- Vector : soft tick of poultry
- Infected birds have ruffled feathers, anorexia, diarrhoea, anaemia, hyperthermia
- Lesions are hepatospleenomegaly, punctiform haemorrhage on serosal surface
- Control of ticks effective and tetracycline therapy

- Haemobartonella felis: Now in mycoplasma
- Disease : feline infectious anaemia, seen on surface of RBC
- Route: Biting wounds/Biting of Arthropods
- Signs: In per acute anaemia: overwhelming parasitemia, rapidly result in death
- In acute cases fever , anaemia, depression, weakness and jaundice
- In chronic cases, anaemia, lethargy and marked weight loss

- Diagnosis: Demonstrate organism on the surface of RBC
- by geimsa staining of blood smear
- demonstration of pathogen in blood smear by immunoflourescence
- heamatological finding as decreased PCV and regenerative anaemia
- Treatment
- Blood tranfusion
- Doxycycline for 21 days
- Control of fleas