Rickettsia
Dr. Hala Al Daghistani
Rickettsia Family

• small (0.3 × 1 to 2 μm)
• stained poorly with the Gram stain
• grew only in the cytoplasm of eukaryotic cells
• Includes the genera:
  • Rickettsia, Orientia (scrub typhus), Coxiella (Q fever, C. burnetti), Ehrlichia, Bartonella
• Intracellular Gram negative rod bacteria
• contain DNA, ribonucleic acid (RNA), and enzymes and ribosomes
• multiply by binary fission
• inhibited by antibiotics
• maintained in animal and arthropod reservoirs
• transmitted by arthropod vectors (ticks, mites, lice, fleas)
• humans are accidental hosts
The organisms can be seen with Giemsa stains
- Require growth co-factors, not grow on artificial media
- Grown in embryonated eggs or tissue culture
- All, except Coxiella, are transmitted by arthropod vectors
- *R. rickettsii* invades the endothelial cells that line the blood vessels
Giemsan stain of tissue culture cells infected with Rickettsia rickettsii
<table>
<thead>
<tr>
<th>Disease</th>
<th>Organism</th>
<th>Vector</th>
<th>Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky Mountain spotted fever</td>
<td><em>R. rickettsii</em></td>
<td>Tick-borne</td>
<td>Ticks, wild rodents</td>
</tr>
<tr>
<td>Rickettsialpox</td>
<td><em>R. akari</em></td>
<td>Mite-borne</td>
<td>Mites, wild rodents</td>
</tr>
<tr>
<td>Scrub typhus</td>
<td><em>O. tsutsugamushi</em></td>
<td></td>
<td>Mites (chiggers), wild rodents</td>
</tr>
<tr>
<td>Epidemic typhus</td>
<td><em>R. prowazekii</em></td>
<td>Louse-borne</td>
<td>Humans, squirrel fleas, flying squirrels</td>
</tr>
<tr>
<td>Murine endemic typhus</td>
<td><em>R. typhi</em></td>
<td>Flea-borne</td>
<td>Wild rodents</td>
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</table>
Rickettsial Diseases

By Groups

Typhus group
- Epidemic typhus
  - *R. prowazekii*
- Lice
- Endemic typhus
  - *R. typhi*
- Fleas
- Scrub typhus
  - *R. tsutsugamushi*
- Mites

Spotted fevers
- Rocky Mountain spotted fever
  - *R. rickettsii*
- Ticks
- Rickettsialpox
  - *R. akari*
- Mites

Others
- Q fever
  - *C. burnetii*
- Inhalation of aerosols

Dr. Abdelraouf A. Elmanama
https://sites.google.com/site/allmicrobiologysite/
1. Entry
   - Tick: Rickettsia
   - Flea: R typhi
   - Louse: R prowazekii
   - Mite: R tsutsugamushi, R akari

2. Spread
   (hematogenous and lymphatic)

3. Disease
   - Encephalitis
   - Pneumonitis
   - Rash (pox and eschar)
   - Nausea and vomiting
   - Kidney failure

4. Exit
   (usually none in man)
Rocky Mountain Spotted Fever (حمى جبال الروكي المرقطة)

- Most common rickettsial disease, More common in USA
- Causative agent is: Spotted fever group (R. rickettsii), Ixodid tick-born transmission
- **Infected vascular endothelial cells**, Incubation of 2-6 days
- Skin rash, extremities, Fever, High mortality if untreated (35% mortality rate).
- Followed by a severe headache, chills, fever, aching, and nausea
- After 2-6 days, a maculopapular rash develops, first on the extremities, including palms, foot soles, and spreading to the chest and abdomen
- Individuals younger than 19 years old are usually at risk, Males affected twice, It is common during summer months
- If left untreated, the rash will become petechial with hemorrhages in the skin and mucous membranes due to vascular damage, death may occur during the end of the second week due to kidney or heart failure
Rickettsia infection of an endothelial cell
Phagocytosis is induced

Bacterium escapes from phagosome

Lysis of cell: R. prowazekii
Filopodium focal lysis: R. rickettsii
Budding: R. tsutsugamushi
Epidemic Typhus (التيفوس الوبائي)

- Also called Brill-Zinsser disease
- Caused by (*R. prowazekii*)
- Unsanitary conditions
- Spread by the human louse
- Also infects endothelial cells
- Signs and symptoms:
  - Intense fever, headache, Rash in axillary folds, trunk
  - Mortality as high as 40% due to clinical complications
  - 7 to 14 days, A rash develops
  - Typically restricted to the chest and abdomen
- Diagnosis: Indirect immunofluorescent assay
Q Fever

- **Caused by** *C. Burnetti*
- **Transmission**: Tick (only to animals), aerosols, infected milk (to human)
  - Many reservoirs, including mammals, birds, sheep, and ticks
  - Most human infections associated with contact with infected cattle, sheep, goats, dogs, and cats
  - Most disease acquired through inhalation; ticks are not an important vector for human disease
- Highly contagious
1. Entry
Aerosol from infected sheep, goats or cattle

2. Spread
Hematogenous (through blood)

3. Disease
Pneumonitis
Endocarditis
Granulomas

4. Exit
Usually none in man
Pathogenicity

- *Coxiella* proliferate in the respiratory tract and then disseminate to other organs
  Febrile illness, rash is rare, Primarily pneumonia, Granulomatous hepatitis, bacterial endocarditis (most chronic infections manifest as endocarditis)
- No seasonal incidence
- Transmission
  - Inhalation of airborne organisms (infected dusts in farm and slaughterhouses)
  - Contact with the milk, urine, feces, of infected animals
- Antigenic variation
- It has spore-like form that resists heat and dryness allowing it to survive in extracellular environment
Characterized by:

- **Acute diseases** include influenza-like syndrome, atypical pneumonia, hepatitis, pericarditis, myocarditis, meningoencephalitis
- **Chronic diseases** include endocarditis, hepatitis, pulmonary disease, and infection of pregnant women
Weil-Felix test

The basis of the test is the presence of antigenic cross-reactivity between *Rickettsia* spp. and certain serotypes of non-motile *Proteus* spp. Typhus group rickettsiae (*Rickettsia prowazekii, R. typhi*) react with *P. vulgaris* OX19, and scrub typhus (*Orientia tsutsugamushi*) reacts with *P. mirabilis* OXK.

The Weil–Felix test suffers from poor sensitivity and specificity
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<td>+++</td>
</tr>
<tr>
<td>Brill-Zinsser disease</td>
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