**Microbiology I**

**Exam III Review**

**Mycoplasmae**

Some Historical Events:

* Nocard and Roux, Eaton
* Pleuropneumonia in cattle
* passes through filters, whereas other bacteria will not
* PPLO – Pleuropneumonia Like Organisms
* 1937 – First Human Strains Recognized
* Many Species:

Non-Pathogenic

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* + *Mycoplasma salivarius*
  + *Mycoplasma orale*
  + *Mycoplasma fermenti*

Other Bacteria Which May Cause Confusion

* L-Forms and Sphaeroplasts
* Mollicutes – the class of bacteria that mycoplasmae belongs to
* Pleomorphic Bacteria (i.e. no cell wall or specific shape)
* Main characteristics of mycoplasms and ureaplasma – comparison

1. **Mycoplasma Pneumoniae –** Eaton’s Agent

* primary atypical pneumonia
* close contact, tracheobronchitis
* pharyngitis
* ear infection
* walking pneumonia
* Treatment/Diagnosis: Cold Agglutinins (“Cold Hemagglutination Test”)

1. **Mycoplasma Hominis**

* Non-Gonococcal Urethritis (NGU) Disease and Possible Complications

1. **Mycoplasma Genitalium**

* in genitals and respiratory tract
* most thoroughly studied mycoplasma
* has the smallest genome
* Culturing: aerobic environment, but 10% CO2 favors growth
* Agglutination (Serology) Elisa, Immunofluorescence
* Treatment: no cell wall inhibitors
* Vaccine: none available

1. **Ureaplasma Urealyticum**

* T-strain (for tiny)
* requires 10% urea in media to grow

**Mycoplasmae (continued)**

Clincally Important Mycoplasmas/Ureaplasma:

1. **Mycoplasma Pneumoniae**

* causes: usually mild pneumonia
* low mortality rate (0.1%)

1. **Mycoplasma Hominis**

* causes: many cases of urethritis
* has been linked to *Pelvic Inflammatory Disease* (PID) and *Pyelonephritis*

1. **Ureaplasma Urealyticum**

* often presents as a mixed infection in STD patients
* causes:
  + low birth weight
  + leading cause of neonatal death
  + pyelonephritis
  + infertility
  + fetal death
  + recurrent miscarriage
  + premature birth

**Rickettsiae**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Disease | Causative Organism | Geographic Prevalence | Arthropod Vector Reservoir | Vertebrate Reservoir |
| Typhus Group | | | | |
| Epidemic (Classic, European) Typhus | *Rickettsia prowazekii* | Worldwide | Louse  Pediculus capitis/corporis  (Head or Body Lice) | Human |
| Brill-Zinsser Disease  (Recrudescent Typhus) | *Rickettsia prowazekii* | Worldwide | Recurring Infection | Human |
| Endemic (Murine) Typhus | *Rickettsia typhi* | Worldwide,  small scattered foci | Flea (of a Rat)  Xenopsyllus cheopis | Rodents |
| Scrub Typhus Group | | | | |
| Scrub Typhus  (Tsutsugamushi Disease) | *Rickettsia tsutsugamushi* | Japan,  Southwest Asia | Mite   1. Trombicula 2. Allodermanyssus | Rat |
| Spotted Fever Group | | | | |
| Rocky Mountain Spotted Fever | *Rickettsia rickettsii* | Western Hemisphere | Tick  Amblyomma | Rodents, Dogs |
| Rickettsialpox | *Rickettsia akari* | United States, Korea, Russia | Mite   1. Dermacenter variabilis | House Mouse |
| Trench Fever | *Bartonella (Rochalimaea) quintana* | Worldwide, but disease only during wars | Louse  Pediculus capitis/corporis  (Head or Body Lice) | Human |
| Bartonellosis | *Bartonella bacilliformis* | Western slopes of the Andes | Sandfly  Phlebotomus | Human are the only  known host |
| Ehrlichiosis | *Ehrlichia canis,*  *Ehrlichia chaffeenis* | Southeastern and south central United States | Tick  Amblyomma | Dogs, Humans |
| Query Fever | *Coxiella burneti* | Sheep growing areas | Droplet Route and Amblyomma |  |

**Rickettsiae (continued)**

Some Historical Events:

* Two guys discovered rickettsiea, Ricketts and Prowazeki.
* Mode for transmission is very unique: insects are used as vectors [Zoonosis – involvement of animals].
* Rash causing organisms (macula popular rash), also cause fever.
* Diagnosis: Weil-Felix Test – uses Proteus Vulgaris as the antigenic material for diagnosing Rickettsia.
  + Proteus Vulgaris is a gram(–) enterobacteria.
  + It is non-pathogenic and has tremendous similarity to Rickettsia (in terms of antigenicity).
* Humans are often accidental hosts, but for some, humans are the sole biological reservoir. Both tetra- and chlora-amphenicol are inhibitory treatments, but they don’t kill the rickettsia – therapy must be prolonged and often they’re not totally eliminated (they can actually reactivate some 20 years after the initial infection)

Additional Notes:

Typhus Group – grows in cytoplasm

Spotted Fever Group – grows in nucleus and cytoplasm

Gram(–) Coccobacillary (small rods)

Bartonella Quintana (Rickettsia/Rochalimae) is the only hypertrophic (culturable) species

Rickettsial Diseases and their Significance

1. **Epidemic (Classic, European) Typhus Fever** [*Rickettsia prowazekii*]
   1. killed Napoleon in 1812, and during WWI, 30 million Russians were infected, and 3 million of them ultimately died… mortality is 3-40%…
   2. transmitted via dead lice organisms that enter the system via open wounds or scratches
   3. incubation is 12 days
   4. symptoms – high fever, headache, rash on trunk (that spreads to extremities)
   5. treated with *Erythromycin* / *Chloramphenicol*
2. **Brill’s-Zinsser** [*Rickettsia prowazekii* (reactivation)]
   1. also known as: Recrudescent Fever Typhus
   2. 1930, affected people in New York and some shit
   3. serologically distinguished from epidemic typhus fever
   4. symptoms – generally milder symptoms and shorter duration, no skin rash
3. **Endemic (Murine) Typhus** [*Rickettsia typhi*]
   1. transmitted via the fleas which occupy rats; similar to epidemic typhus transmission
   2. similar to the deadly ‘plague’
   3. seen in USA gulf coast – 100 cases per year
   4. 2% mortality rate; it’s described as being ‘self limiting’
   5. incubation is 10-14 day
   6. symptoms – fever, headache, rash
4. **Scrub Typhus (Tsutsugamushi Disease)** [*Rickettsia tsutsugamushi*]
   1. tsutsugamushi means bad little bug
   2. soldiers get it when they crawl/serpentine
   3. if left untreated, it has a 50% mortality rate
   4. symptoms – fever, chills, headache, sloughing lesions at the site of the bite, spotty rash
5. **Rocky Mountain Spotted Fever** [*Rickettsia rickettsii*]
   1. first to be recognized as a rickettsial disease (Idaho, Montana)
   2. misnomer in that it’s geographically more prevalent near the Appalachians
   3. incubation is 3-4 days
   4. symptoms – fever, headache, rash on extremities (that spreads to trunk)
6. **Rickettsialpox** [*Rickettsia akari*]
   1. resembles chickenpox
   2. is not deadly
   3. symptoms – vesicular rash (fluid-filled)
7. **Trench Fever** [*Bartonella (Rochalimaea) quintana*]
   1. also known as: Shinbone Fever, 5-Day Fever, Polish-Russian Intermittent Fever, His-Werner Disease
   2. prevalent during war times, where there is a lack of cleanliness and stress plays a major factor
   3. it’s the only hypertrophic (culterable) rickettsia
   4. Trench Coats were covered with some shit that was intended to deter the Lice vector, but it wasn’t entirely effective.
   5. Today, typically only urban poor individuals suffer this.
   6. symptoms – leg pain, exhaustion, depression, and it’s recurrent in some soldiers.
8. **Bartonellosis [***Bartonella bacilliformis*]
   1. two divisions:
      1. Oroya Fever or Carrions Disease – acute fatal fever with severe anemia
      2. Verruga Peruana – chronic non-fatal skin disease
   2. Dan Carrion inoculated himself and died of oroya fever
   3. incubation ranges from weeks to months
   4. symptoms – oroya fever causes severe febrile (fever causing anemia)
   5. *Oroya Fever* occurs in people with no immunity
   6. *Verruga Peruana* occurs in people with partial immunity
9. **Ehrlichiosis** [*Ehrlichia canis; Ehrlichia chaffeenis*]
   1. originally in dogs, though it’s transmitted via the ticks whom occupy the infected dog
   2. ioxides are ticks that spread lyme disease
   3. symptoms – fever, headache, hepatitis, myalgia, and no rash
   4. diagnosed with presence of intracytoplasmic inclusions of white blood cells is present
10. **Query Fever** [*Coxiella burneti*]
    1. Coxiella burneti survives in wool, dried blood, in water, and milk.
    2. has two forms:
       1. large form
       2. small form – spore like body that enters the human cells by phagocytosis; it multiplies in phagosomes and various parts of the body become infected
    3. can be transmitted via tick bites, feces, or genital secretions; contaminated milk can transmit it
    4. cattle and sheep in growing areas show this disease
       1. occupational hazard for dairy workers, cattle ranchers, and people at tanneries
    5. *Flash Pasteurization* was developed to prevent this specific malady.
    6. incubation is 18-20 days
    7. symptoms – headache, chills, malaise, sweats (like Primitive A type Pneumonia symptoms)
    8. treated with *Tetra-* and *Fluoro-Quinolone*; leaves lifelong immunity (also, vaccine is available)

**Protista**

1. **Sarcodina** **–** Amebas, commonly exist and interchange between two forms: a trophozoite form (free moving) and a cyst form (spore like). They obtain food by phagocytosis and reproduce by binary fission only.
2. **Acanthamoeba castella** 
   1. damages: pancreas and skin
3. **Acanthamoeba polyphaga** 
   1. hot tub associated
   2. damages: eyes, liver, kidneys, brain, and lungs; is sometimes deadly
4. **Naegleria fowler (Gruber?)** 
   1. swimming can transmit
   2. causes *primary amebic meningio-encephalitis* (PAME)
5. **Entamoeba histolytica**
   1. transmitted through water/food containing cysts
   2. causes amebic dysentery, amebic hepatitis, amebic meningitis
   3. poor sanitation is the main cause
6. **Dientamoeba fragilis**
   1. causes chronic mild diarrhea
7. **Mastigophora –** Conducts motion via flagella and an undulating membrane. They obtain food by permeation and reproduce by binary fission. Sexual reproduction is questionable.
8. **Trypanosome gambiese (gambiense)** 
   1. transmitted by tse tse fly
   2. it’s a blood parasite
   3. causes encephalitis (African Sleeping Sickness)
   4. Trypanosome rhodisiense, another species, is treated with *pentamidine*
9. **Trypanosome cruzi**
   1. transmitted by kissing bug or assassin bug; is an insect also known as a reduviid bug
   2. can form a pseudocyst and is a blood parasite
   3. causes Chagas disease; anemia, muscle pain, nervous disorders, and even heart disease
   4. can travel across placenta
   5. destroys (mortality) by CNS and CVD**?**
   6. no effective treatment available
10. **Giardia intestinalis** 
    1. is water born
    2. forms a pseudocyst (~resting form); is the most primitive eukaryote
    3. causes diarrhea, dehydration, and nutritional deficiency
11. **Leishmania donovani**
    1. transmitted by the sand fly (phlebotomas)
    2. blood borne
    3. causes high fever, liver and spleen enlargement
12. **Leishmania braziliensis**
    1. causes skin lesions
13. **Leishmania tropica**
    1. causes skin lesions, oriental sores, and delhi boils
14. **Trichomonas vaginalis**
    1. sexually transmitted
    2. causes intense itching, copious discharges, and a nasty smell
    3. treated using *metronidazole*
15. **Trichonympha collaris**
    1. damages us indirectly – termites have this within their guts (as a form of mutalism).

**Protista (continued)**

1. **Cliophora** – Conducts motion via hairy celia all over the body. *Paramecium* – reproduces via sex as well as binary fission.
2. **Blantidium coli**
   1. pseudocysts within feces (diagnosed by these indicators)
   2. causes dysentery and perforations of the gut
3. **Apicomplexa** – Was earlier known as Sporozoa: the group is characterized by organisms that are immobile as adults (only their sperm sex cells are mobile). The organisms form a variety of spore like structures (sporozoites, merozoites, trophozoites, et cetera) during their life cycle. The name Apicomplexa comes from the fact that some invading cells (cells that invade host cells) carry an enzyme at the tip that digests the host cell membrane.
4. **Plasmodium falciparum (Malarial Parasite)**
   1. Malaria is endemic in tropical areas—½ billion cases and 3 million deaths per year globally
   2. transmitted by female Anophlene mosquito by injecting sporozoites
   3. causes periodic high fever and chills; blood cells agglutinate causing ischemia
   4. also known as ‘Black Water Fever’ – urine is blackened due to the breakdown of hemoglobin
   5. liver damage (Jaundice) and kidney damage seen
   6. treatment – *Quinine* (a cinchona bark product) \*also for prevention
      * Tangent: Malaria therapy (M.vivax) treats syphilis
5. **Toxoplasma gondii**
   1. exists in 3 forms:
      * trophozoites – in blood
      * tissue cyst – embedded in muscles
      * oocysts – cat’s fecal material
   2. can be congenitally transmitted—causing embryonic arrest
   3. other symptoms: typhoid like fever, mononucleosis like, anemia, jaundice, brain damage in babies, retinochoroiditis (eye infection), abnormally small head, uveitis, still birth, birth defects, abortion, encephalitis… linked to schizophrenia – 50% of mothers of schznophrenics are positive to *toxoplasmosis*
   4. diagnosis – biopsy and Sebin Feldman Dye Test (which tests for toxoplasmosis)
   5. treatment – *Pyrimethamine* and *Trisulfapyridine*
   6. prevention – cook meat well; if pregnant, don’t handle cat liter
6. **Cryptosporidium parvum**
   1. water born encysted
   2. Milwaukee 1993 - 400,000 cases (100 killed)
   3. causes deadly diarrhea, and dehydration
   4. special problem in immune-compromised and AIDS
   5. no effective treatment available
7. **Babesia bigemina**
   1. transmitted by ticks
   2. divide within erythrocytes
   3. symptoms: fever, anemia, muscle pain, jaundice
   4. deadly for people who have had their spleen removed
   5. treatment – *Chloroquinine*
   6. prevention – don’t get tick bites
8. **Cyclospora cayetanensis**
   1. carried by Guatemalan raspberries
   2. recognized in 1996
   3. fecal oral route of transmission
   4. causes flu like symptoms, diarrhea, abdominal pain, and anorexia