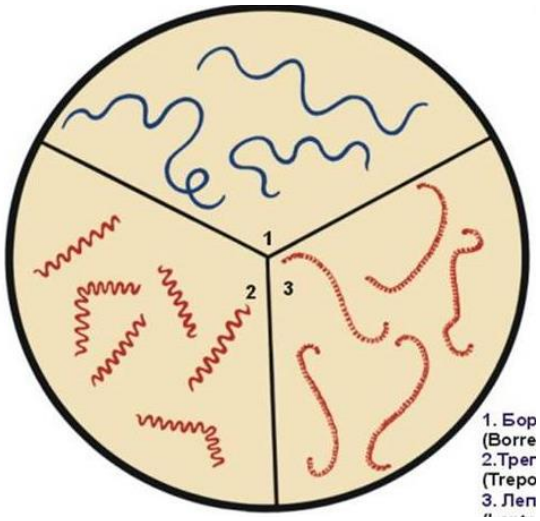
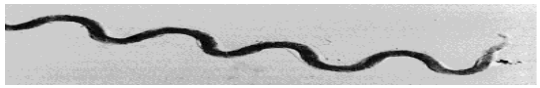
# Medical Bacteriology- Lecture 13

## Spirochaetales




### *1- Spirochaetaceae*



***Treponema***
***Borrelia***

### *2- Leptospiraceae*

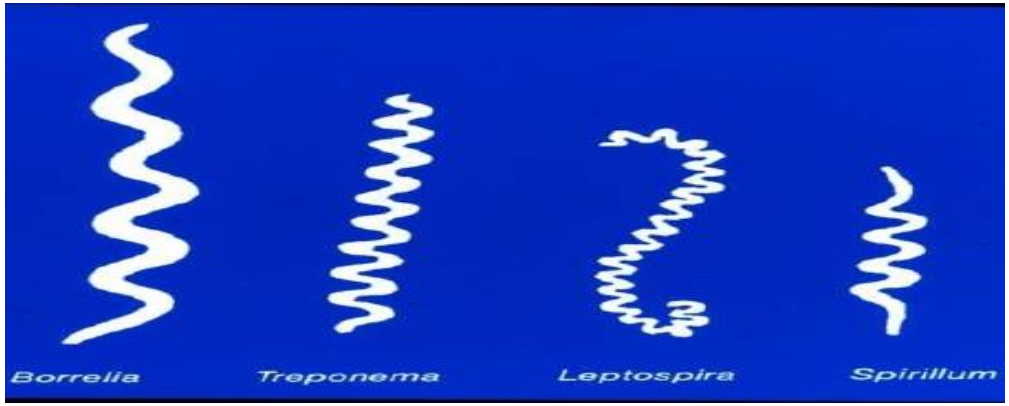
***Leptospira***


*Leptospira interrogans*

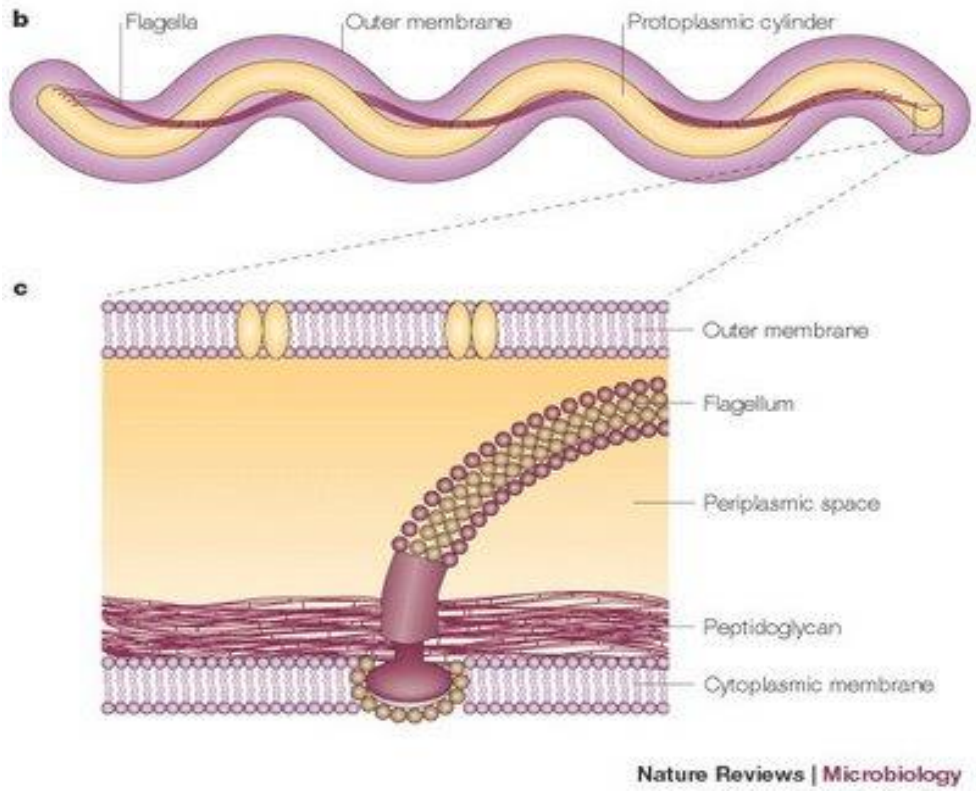
# Spirochaetaceae

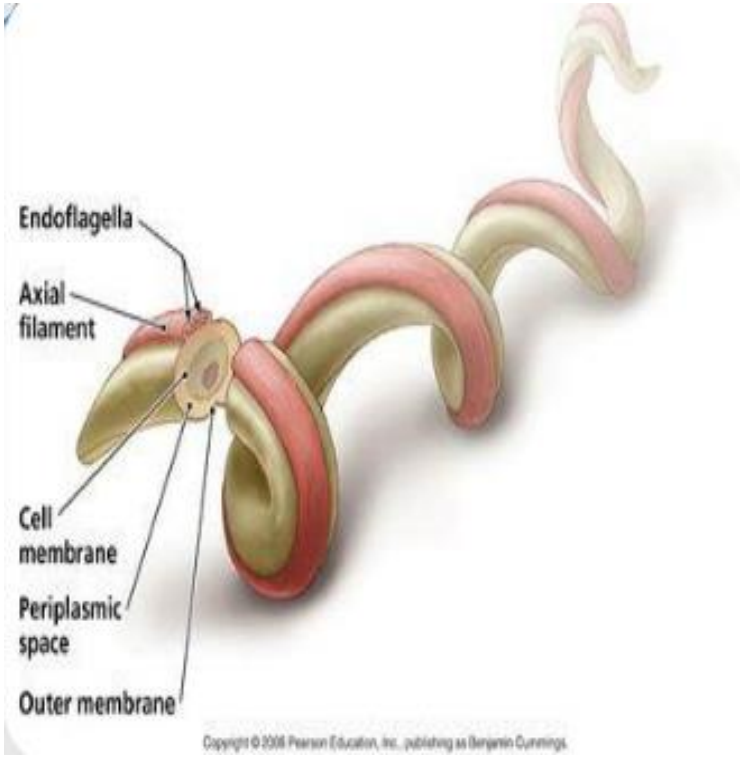
- **Characteristics:**
- Helical single cells, spiral or cork-screw-shaped, extremely thin and can be very long
- Gram negative, aerobic to strict anaerobic, free or strict parasites.
- motile, move by bending and rotating body movements.
- Spirochete consist of protoplasmic cylinder bounded by a cell wall and outer membrane. There is an **axial filament or endoflagella (preiplasmic flagella)** between the cell wall and outer membrane.

- **Spirochetes of medical importance:**
- **1- Treponema**
- *T. pallidun*--- cause Syphilis
- *T. peretenue*-----cause Yaws- 3 stages- (granulomatous disease)
- *T. carateum*------- cause Pinta (primarily restricted to skin- tropical area)
- **2- Borellia**
- *B. recurrentis*----- cause relapsing fever
- **3- Leptospira**
- *L. interrogans*----- cause Leptospirosis



# Spirochaetaceae

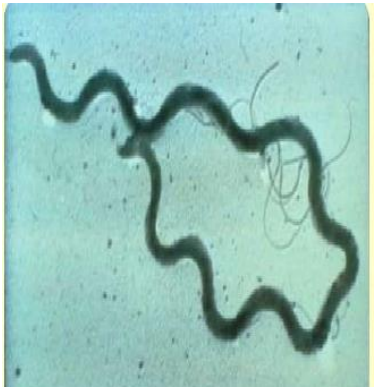


# *Treponima pallidum*

**Cause syphilis (**Primarily sexually transmitted disease (STD) or by **congenitally from mother to fetus )**

- Slender spiral, microaerophilic gram-negative rods.
- Too thin to be seen with light microscopy in specimens stained with Gram stain
- Intracellular pathogen
- Not cultured in artificial media, cultured in fertilized eggs and tissue culture (Do not survive well outside of host)
- Actively motile, rotating steadily around their endoflagella
- Remain viable in the blood or plasma store at 4c at least for 24 hrs (transmitted via blood transfusion)
- Incubation period is 3-4 weeks.
- Route of transmission is sexual contact and congenitally.
- Rash, fever, organ damage



# *Pathogenesis of T. pallidum - Primary Syphilis*

- Primary disease process involves invasion of mucus membranes, rapid multiplication & wide dissemination through lymphatics and systemic circulation

- 10-90 days (usually 3-4 weeks)

- inflammatory response at the site of infection resulting in the hallmark syphilitic lesion, called the **chancre (usually painless)**
  - Chancre changes from hard to ulcerative with profuse shedding of spirochetes
  - Swelling lymph nodes
  - Primary lesion heals spontaneously two months, leading to false sense of relief

# *Pathogenesis of T. pallidum - Secondary Syphilis*

- 2-10 weeks after primary lesion

- Widely disseminated mucocutaneous rash

- Secondary lesions of the skin and mucus membranes are **highly contagious**

- Generalized immunological response

## *Pathogenesis of T. pallidum - Latent Stage Syphilis*

- Following secondary disease, host enters latent period
  - First 4 years = early latent

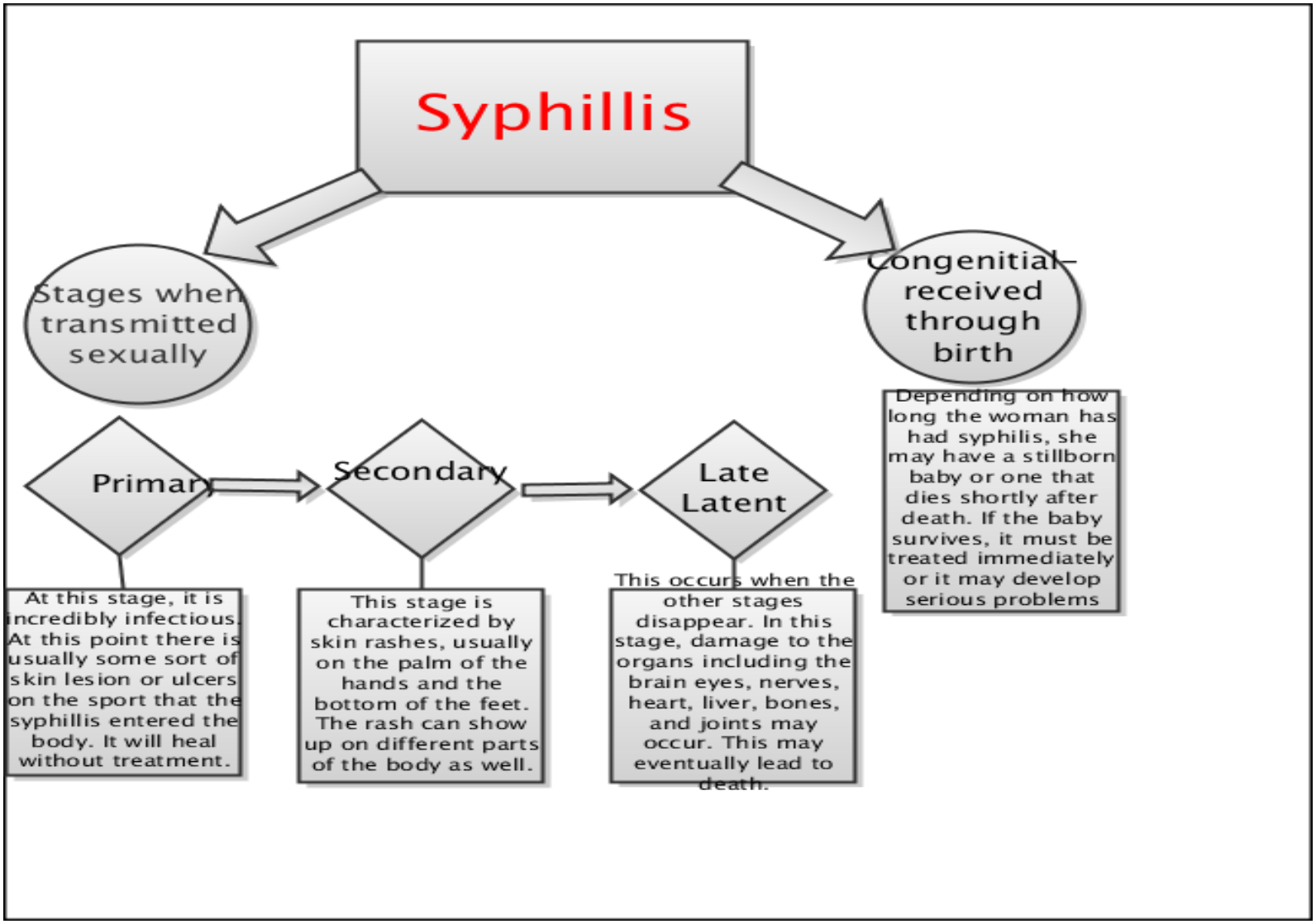
- About 40% of late latent patients progress to late tertiary syphilitic disease

## *Pathogenesis of T. pallidum - Tertiary Syphilis*

- characterized by localized granulomatous dermal lesions **(gummas)**
- Granulomas reflect containment by the immunologic reaction of the host to chronic infection

- Late neurosyphilis develops in untreated cases, usually more than 5 years after initial infection
  - Central nervous system and spinal cord
  - Dementia, wasting, etc.

- Cardiovascular involvement appears 10-40 years after initial infection with resulting myocardial insufficiency and death


Syphillis
Stages when transmitted sexually
Congenitial– received through birth
Depending on how long the woman has had syphilis, she may have a stillborn baby or one that dies shortly after death. If the baby survives, it must be treated immediately or it may develop serious problems
Primary
Secondary
Late Latent
At this stage, it is incredibly infectious. At this point there is usually some sort of skin lesion or ulcers on the sport that the syphillis entered the body. It will heal without treatment.
This stage is characterized by skin rashes, usually on the palm of the hands and the bottom of the feet. The rash can show up on different parts of the body as well.
This occurs when the other stages disappear. In this stage, damage to the organs including the brain eyes, nerves, heart, liver, bones, and joints may occur. This may eventually lead to death.

# Congenital syphilis

- **Route of transmission:** Mother-to-child during gestation (transplacental infection).
- **Out come:** Abortion
- Fetal death

- **Organ damage:** Congenital syphilis
- keratitis
- Deafness

# Syphilis Diagnosis

- **Diagnosis:**
- **Direct:** Motile spirochetes in dark field microscope
- Immunofluorescence stain (Staining with anti-treponemal antibodies labeled with fluorescent dyes)

- **Indirect: Serological tests for syphilis (STS): Two classes of serological test: (nonspecific and specific tests)**

**A- Non-treponemal antigen test (detect antibodies to nonspecific antigen)**(Antigen- Cardiolipin from beef heart antigen ) eg:

- **1. Flocculation test –venereal disease research laboratory (VDRL), rapid plasma region (RPR)**
- **2. Complement fixation test**
- **3- Wasserman test**
- Low sensitivity in early and late disease
- Usually revert to negative after treatment

**B- Treponemal antigen tests (detect antibodies against specific *T. palladium* antigens). eg:**

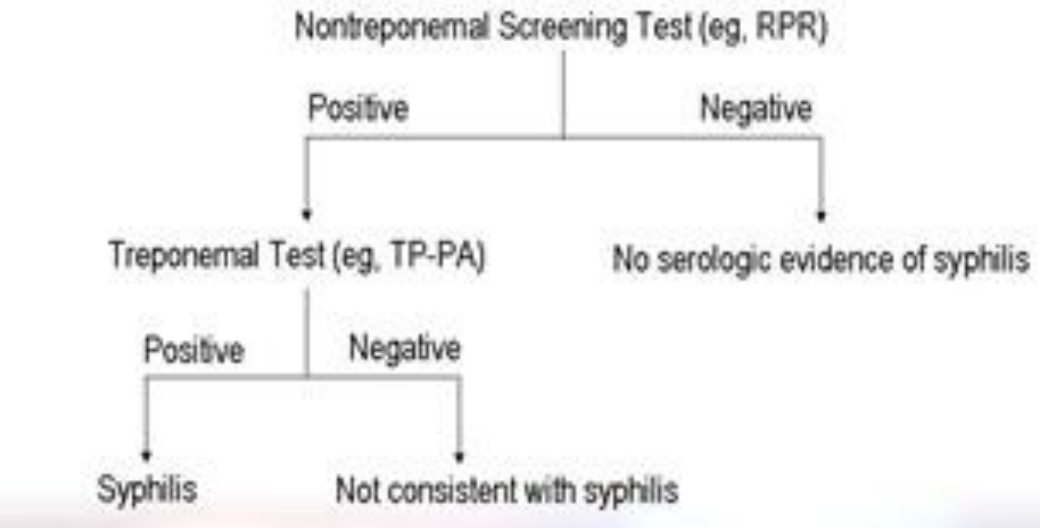
- **1- Indirect Fluorescent treponemal antibody-absorption test (FTA-abs)**
  **2- *T. pallidum*- particle agglutination test (TP-PA)**
- **3- *T. pallidum* immobolizing test (TPI)**

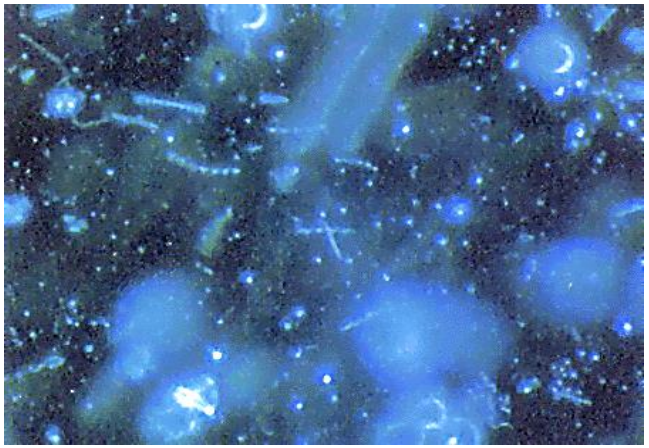
- Remain positive for years despite treatment

- **Treatment:** Penicillin- Tetracycline- Erythromycin

# *Diagnostic Tests for Syphilis*

| Diagnostic Test | Method or Examination |
|---|---|
| Microscopy | Darkfield |
| | Direct fluorescent antibody staining |
| Culture | Not available |
| Serology | Nontreponemal tests |
| | Venereal Disease Research Laboratory (VDRL) |
| | Rapid plasma reagin (RPR) |
| | Treponemal tests |
| | Fluorescent treponemal antibody absorption (FTA-ABS) |
| | Microhemagglutination test for *Treponema pallidum* (MHA-TP) |



**Dark field Microscopy of *T. pallidum***

# Virulence Factors of *T. pallidum*

- Outer membrane proteins promote adherence
- Hyaluronidase
- Antiphagocytic coating of fibronectin
- Tissue destruction and lesions are primarily result of host's immune response.

# Borrelia

- ***Borellia recurrentis*: Causative agent of relapsing fever- (transmitted by lice, one relapse)**
- Highly flexible irregular spiral organism, and move by rotation and twisting
- Cultured in complex serum-rich artificial media and embryonated eggs.
- Famous in antigenic variation.

  - ✓ Transmitted person-to-person by human body lice (vectors) from infected human
  - ✓ Infect host only when louse is injured, e.g., during scratching
  - ✓ Lice leave host that develops a fever and seek normal temperature host

***Borellia hermsii:* Tick-borne borrelliosis: Relapsing Fever (transmitted by ticks, three relapses).**

- ✓ Sporadic cases
- ✓ Transmitted by soft body ticks (vectors) from small mammal reservoir
  Ticks can multiply and infect new human hosts

**Light Microscopy *of* *Borrelia recurrentis* in Blood**

# Epidemiology of Borrelia Infections

*Borrelia recurrentis*

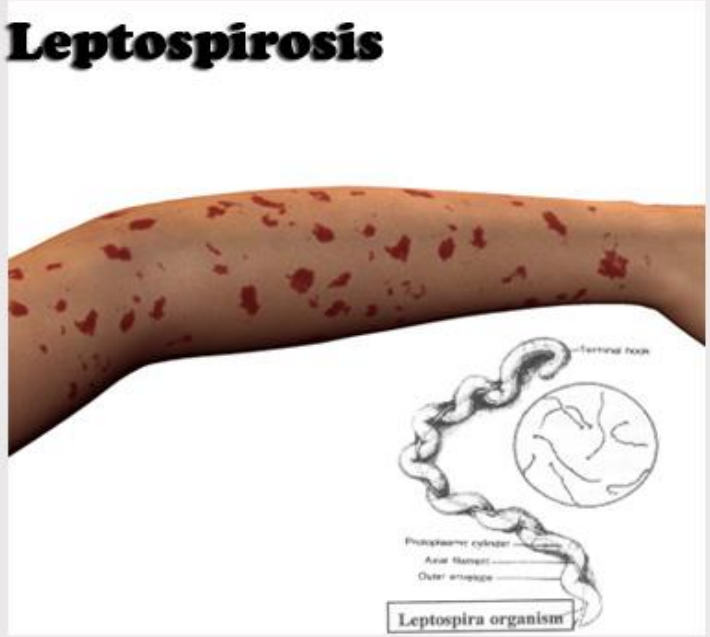
*Borrelia hermsii*.

*Borrelia burgdorferi*

| Infection | Reservoir | Vector |
|---|---|---|
| Relapsing fever Epidemic (louse-borne) | Humans | Body louse  |
| Relapsing fever Endemic (tick-borne) | Rodents, soft-shelled ticks | Soft-shelled tick  |
| Lyme disease | Rodents, deer, domestic pets, hard-shelled ticks | Hard-shelled tick  |

# Leptospira

- ***L. interrogans :*** ***cause leptospirosis***
- Tightly coiled, thin, flexible spiraled spirochetes forming one polared **hooked ends**
- Grow best in semisolid (Fletcher's) media under aerobic condition at 28-30C
- Obligate aerobes
- Can survive for weeks in **alkaline PH water**
- Fatty acid oxidation is major source of energy
- Essentially zootonic infection and humans are accidental host
- Source of infection is contaminated food and water




**Silver Stain of *Leptospira interrogans***

# Review Question

- What do you know about Congenital syphilis
- Untreated syphilis progresses in a series of distinct stages (primary, secondary, latent, and tertiary.), what do you know about them?
- Compare between *Borrelia recurrentis* and *B. hermsii*? (the vector- number of relapse)
- What is the causative agent of Syphilis, leptospirosis
- What do you know about immobilizing test?
- What is the major characteristics of Spirochetes?
- What is the transmission ways of Syphilis disease?
- Give three examples of spiral bacteria?
- What is the major characterstic of *leptospira interrogans?*