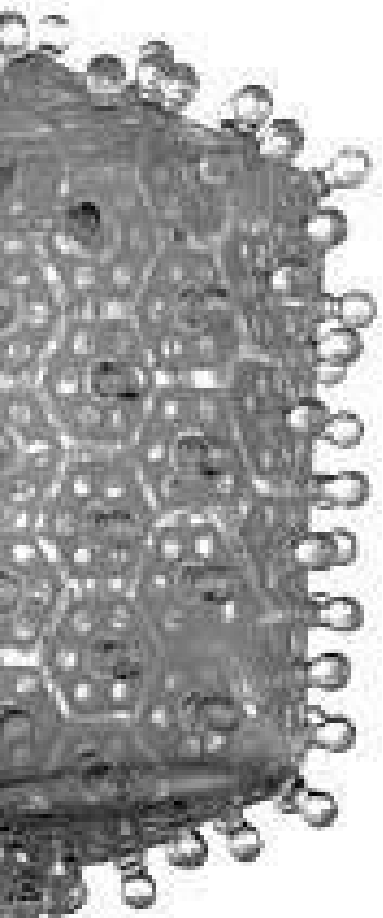

Microbiology

Lecture No: 28

Dr Name: Dr. Asem

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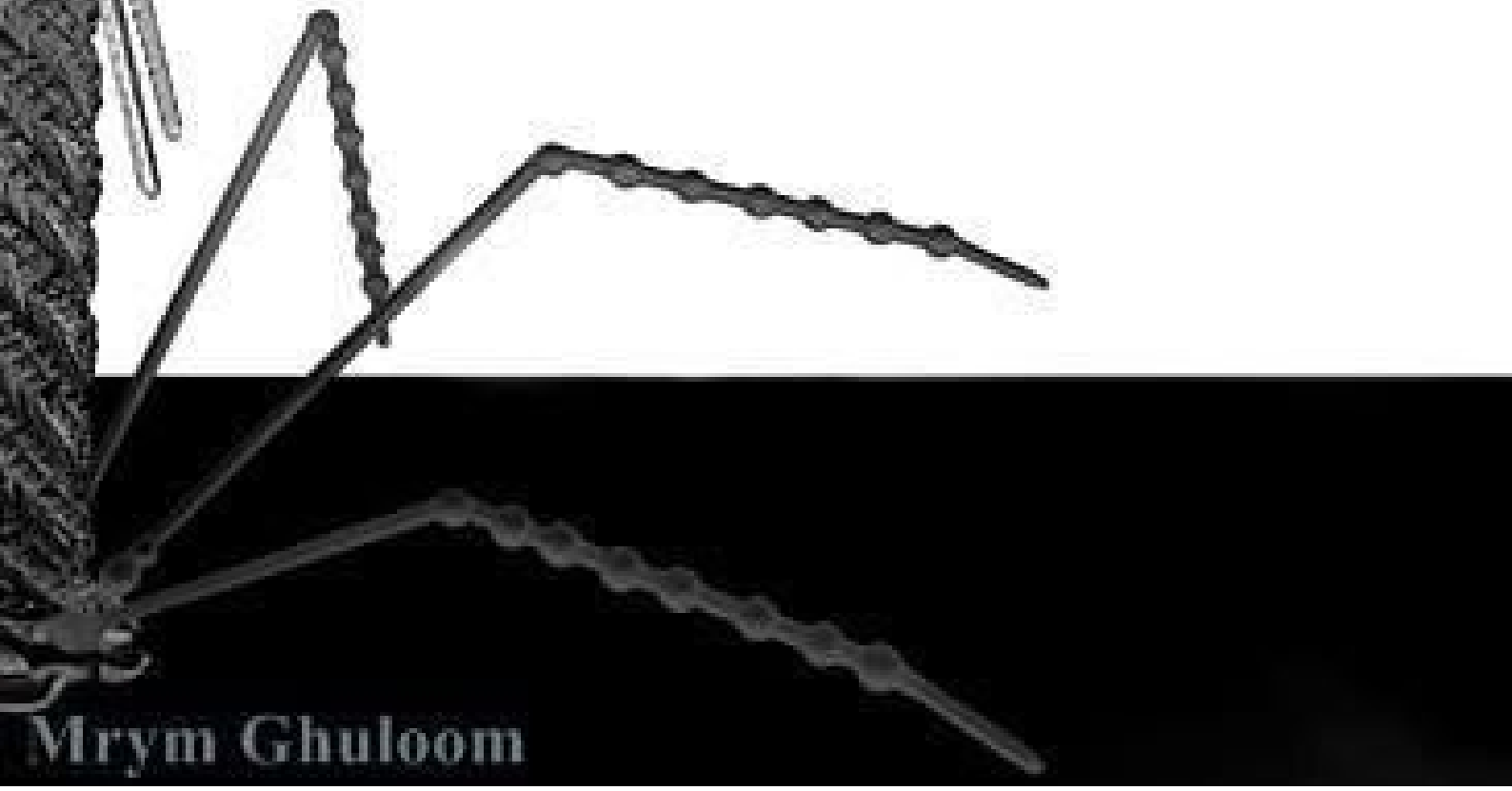

Mrym Ghuloom

Chlamydia, Mycoplasma, and Legionella Mycobacteria

- Introduction:

There are 3 organisms (belonging to 3 important groups) of smaller microorganisms which aren't easily cultured from clinical specimens, and to a certain extent the infectious diseases that they cause aren't easily recognized. This is due to the fact that these organisms might be associated with atypical form of infection.

I. Chlamydia:

A) **Chlamydia is related to Gram Negative Bacteria** due to the fact that its cell wall contains a small amount of peptidoglycan layers. Despite this, it's not easily detected by using the Gram Stain like other G-ve or G+ve bacteria.

B) Chlamydia grows mainly as an **intracellular organism** specially in relation to our body tissue as well as types of Chlamydia which is found in animals. Therefore, we can not culture this type of intracellular organism on a typical culture media; we have to use a special tissue culture: we have many types of tissue cultures which might be originated from the liver, kidney or other part of the body**;** usually we use a type of culture media called **McCoy Culture Medium.**

C) In other types of bacteria we have usually only one growth pattern by the presence of single cells and those by binary fision produce doubled number of the cells and so on so we eventually recognize the presence of a single colony of growth of the isolated organism, but Chlamydia has a special replication cycle (a special growth pattern) composed of two types of structural cells ; one type of structural cells which is considered as an infectious part that infect our respiratory tract or other part of our body is called the infectious elementary bodies, it is a

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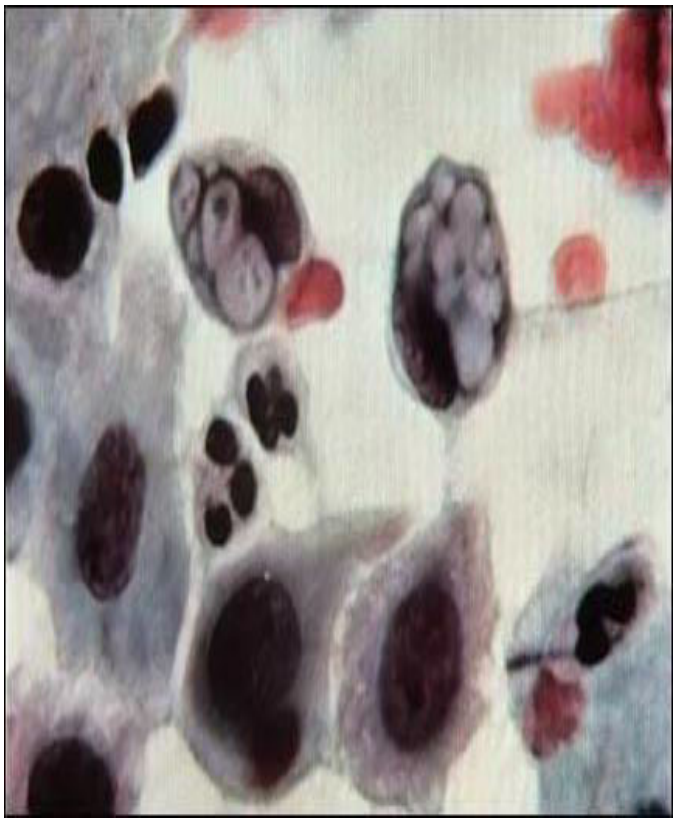
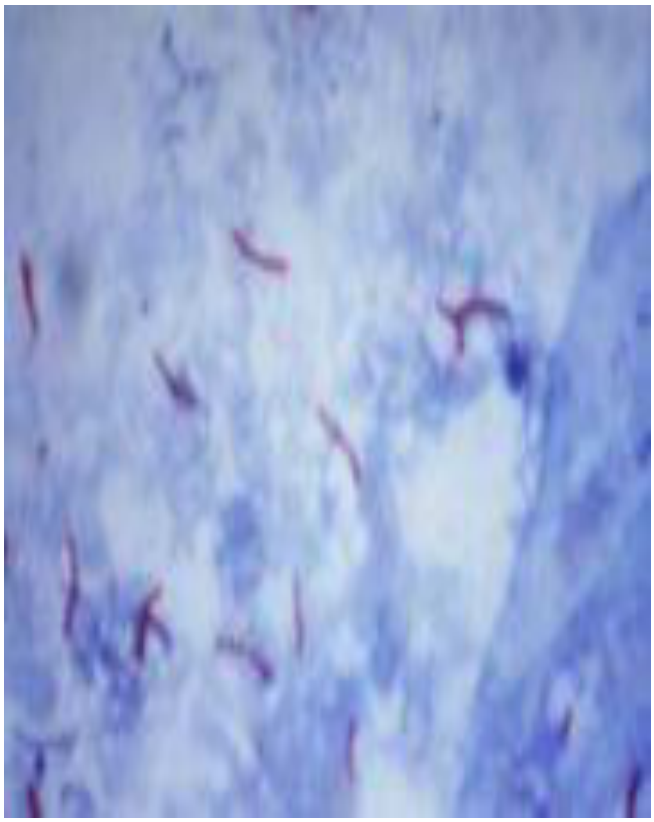
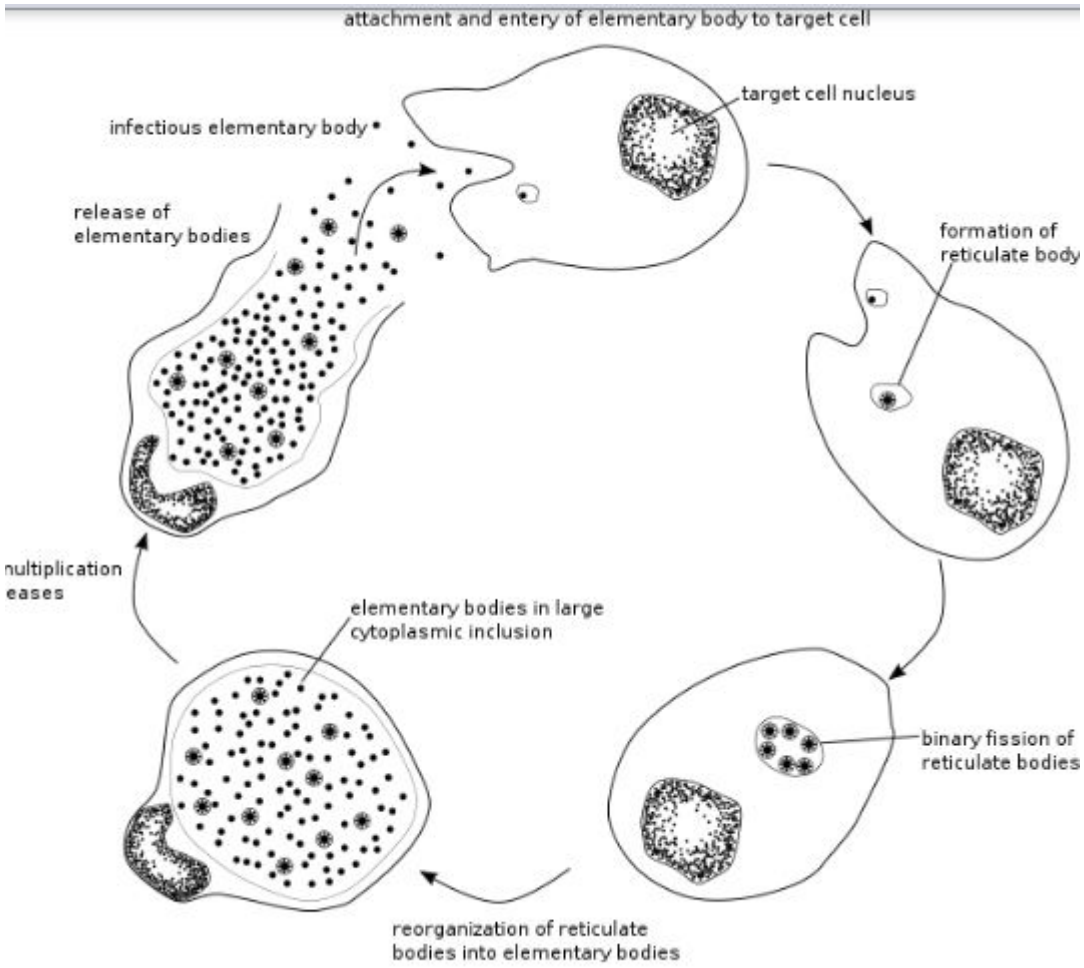
small cocci structure, this once reaches as an example the tissue of the lung and produces infection, will be converted to the second stage of growth **inclusion bodies**, these inclusion bodies within infected cells replicate and produce non-infectious reticulate bodies so single –cocci structure will be developed to four, eight, or more structures within inclusions and after rupture of these inclusions, they release again the elementary bodies which are single cocci structures and those are considered agian as an infectious agent.

(Alternation between an **infectious elementary body**, and a **replicating non-infectious reticulate body**.)

Chlamydia inclusion bodies/Acid-Fast Mycobacteria







The picture above shows the unique life cycle of Chlamydia (for clarification).

*Note: Recall that bacteria usually has one growth pattern and multiplies by Binary Fission forming single colonies.

D) Chlamydia are composed of pathogenic and non-pathogenic species. Pathogenic species have certain specifications regarding to causing infection in a particular part of our bodies:

-Chlamydia Trachomatis: causes one of the most common **sexually transmitted diseases** in Western countries having at least from 100 to 200 million cases each year, this is a huge number of cases and the majority of these cases are not well recognized because the features often are considered asymptomatic or mild infection and this will always increase the number of cases. It mainly infects the **genital tract**, and is associated

with the development of infections through close **sexual contact**. It's often associated with an **asymptomatic infection**. **Pregnant mothers** during pregnancy specially in the delivery can transmit the disease to her fetus, infecting its **eyes** causing an inflammatory reaction in the conjunctiva and later in the cornea, producing trachoma; trachoma means developing damage in the conjuctiva causing blindness; and this is associated with blindness so it can be so severe.

Therefore, presence of Chlamydia Trachomatis in pregnancy should be treated with anti-microbial drugs or following pregnancy a drop of anti-microbial solution drugs usually should inoculated in the eyes of the new born baby in order to kill the possible presence of this organism.

Chlamydia Trachomatis may reach the lungs of the newborn causing fatal pneumonia. (rarely)

According to the WHO statistics, Chlamydia Trachomatis is responsible for at least 100 to half a million cases of Trachoma in certain countries.

Presence of this organism in n the genital tract might be associated with developing **non-specific urethritis**. The term "non-specific" is used to distinguish it from specific urethritis which is caused by Sexually Transmitted Diseases (STDs) like the one caused by Neisseria Gonorrhea. This non-specific urethritis may be mild, associated with a few amount of inflammatory reaction in the mucosa of the urethra which may reach the uterus in ladies, associated with **discharge of few amount of pus cells in contrast to the urethral/vaginal discharge caused by Neisseria Gonorrhea**.

It may be associated with infection of any part of the genital tract like:
Males: Prostatitis (more easily detected).

Females: Vaginitis (associated with vaginal discharge which is easily detected)/Cervicitis

When left **untreated** with specific antibody, complications may occur and cause infection in the fallopian tubes and produce damage leaing to **infertility.**

-**Chlamydia Pneumoniae** (called so because it is associated with pneumonia): mainly infects the **upper respiratory tract, and is associated with pneumonia**. It's found in a certain percentage of the population without clinical features. Under certain conditions, especially following bacterial or viral infections, it might be activated and produce a case of **atypical pneumonia**.

To differentiate:

~The clinical features of *atypical pneumonia* are: generally mild in the beginning, associated with a dry cough, possible fever, abdominal pain, and some GI symptoms.

These symptoms continue for around 1-4 weeks. Patients may recover without treatment or require treatment with anti-microbial drug depending on the case.
So it is not nesseccary to be associated with a fatal outcome or complications like the one caused by typical pneumonia.

~The clinical features of *typical pneumonia* are associated with a **chronic form of allergic reactions (which may cause confusion between them and between patient suffering from allergic reactions)**, complications like; productive cough; there is spelling of sputum (restless).

*Note: **Chlamydia Pneumoniae is not a common cause for pneumonia in Jordan** (it may cause a small percentage), and it is not easily to be discovered; sometimes it might be considered as a viral infection. It affects all ages, but children may have more chronic symptoms than adults. And rarely there are complications associated with this disease.

Both Chlamydia Trachomatis and Chlamydia Pneumoniae aren't easily cultured in media avaible in most laboratory, they are only

cultured in tissue culture like McCoy tissue Culture and this is usually done only in research centers, they can be detected by special immunoflourescence technique with immunoflourescence microscopy (Chlamydia Pneumoniae might be discovered by the developing of specific antibodies against the antigens of Chlamydia, and this can be done after at least 4 weeks of infection, because the specific antibodies will not develop like other organisms rapidly, it will develop slowly). The PCR molecular technique has recently introduced in order to identify these organisms.

There is no vaccine for these two microorganisms.

II. Mycoplasma:

In contrast to Chlamydia, it's a large group of atypical organisms related to atypical pneumonia and other types of diseases. Some of its species are adapted to humans, and others are adapted to animals. **Mycoplasma infect the respiratory tract of humans, animals and birds**. This organism spreads between humans and animals, but each specie of mycoplasma is related to a certain.

A) It's a **"Gram Negative-like" organism**, but **can't be demonstrated by the Gram Stain** because it **lacks many (almost all) components of the G-ve bacteria**. It has very few amount of: peptidoglycan layers (peptidoglycan layers are related to the presence of cell wall), endotoxins, and lipoproteins. In contrast to Chlamydia, **Mycoplasma can be cultured on artificial- media** by culturing it on a fluid media then sub-culturing later on a solid media.

B) Mycoplasma do not have a replication cycle, there is only one growth pattern like other bacteria by: **Binary Fission**. (Unlike Chlamydia)

We have at least three important species:

-Mycoplasma Pneumoniae: Causes exactly atypical form of pneumonia like chlamydia so clinically you cannot distingush that the patient is infected by this or that microorganism without doing serological test to recognize the specific antibodies against Mycoplasma or Chlamydia. Mainly produce infection old children and young adults more than in other age groups. Infection usually begins with inflammation of the Pharynx & Larynx, leading to Pharyngitis, and later Bronchitis. associated with a dry cough, rarely with productive cough if it is associated with Staph or Strep, prolonged not high fever is often associated with this organism specially if there are no sign and symptoms related to viral or other bacterial disease. It is usually found in outbreaks (e.g.: in school children/university students/militaries) not in single cases.

-Mycoplasma Legionella: forms an atypical form of pneuomonia (exactly the same kind that Chlamydia causes). It's hard to diagnose without having any tests (to identify specific antibodies against Mycoplasma of Chlamydia) done.

- **Mycoplasma hominis**: usually considered as a part of the **oral flora,** found as normal saprophytic or commensal without any significance. Might be associated in addition to certain type of bacteria in causing localized inflammatory reactions in the form of **ulcerations in the oral cavity**, but it alone can't cause infections in the oral cavity.

- **Mycoplasma genitalium** (from genitalia)**:** it's to some extent exactly like Chlamydia trachomatis, found in **the genital tract** of men and women and is under **asymptomatic condition** and **symptomatic condition**. There's still no enough information why M.genitalium produces inflammatory reaction in the genital tract of the infected person, it may be found in a person without any pathological significance (without causine any inflammation or any non-specific urethritis or any other disease) but at the same time it might produce under certain condition mainly in

association with other STDs like N.gonorrhea or Chlamydia the presence and symptoms mainly in form of non-specific urethritis; which means they all have the same clinical feature, and therefore, M.genitalium is considered to cause a **sexually transmitted disease (STD**) but it is not so common as Chlamydia Trachomatis.

It may be associated in ladied with Cervicitis or Vaginitis (discharge of fluid). Rarely reaches the blood stream and produces sepsis. Often produces localized infections in the genital tract (It cannot spread to the repiratory tract of new born babies like Chlamydia Trachomatis).

M.Pneumoniae & M.Genitalium are easily cultured and recognized.

M.Pneumoniae: by doing serological tests for recognizing specific antibodies.

M.Genitalium: by culture or by the use molecular techniques (presence of specific antibodies cannot tell to diagnose a case of the infection of it).

Treatment: antimicrobial drugs and there are no vaccines.

III. **Legionella pneumophila:** related to features of pneumonia (usually in humans). It's a large group of bacteria, and is **found widely in nature**, especially in **water habitats** which can contain around 20 types of Legionella. Only one Legionella causes atypical pneumonia, but it's more dangerous, and has more complications in relation to the CNS and the kidney .

This organism is **Legionnaires Legionella** & it causes **Legionnaires' Disease** (infection of old soldiers) where there was an outbreak related to this type of bacteria and 200 of soilders acquired that infection at that time , firstly,they thought this microorganism is another type of bacteria but finally after intensive diagnosis by studying a lung of a dead soilder they discovered the severity of the microorganism and it

was named separately,it can produce a **severe type of pneumonia** which can be **very fatal** for the elderly and immune-suppressed patients/smokers. Within a short period of, time, it produces a high fever, headache, and other symptoms related to the organisms that cause typical pneumonia such as Streptococcus pneumonia. It also affect all parts of the body causing muscle weakness, abdominal pain, vomiting, and sometimes kidney failure along with blood sepsis.
It is **intracellular** and multilplies in **macrophages** this is why it is considered to be very dangerous .

So, what makes Legionella pneumophilia different from Chlamydia and Mycoplasma?
***Chlaydia and Mycoplasma** might be found in the **respiratory tract or the genital tract without causing any disease.** BUT:*

***Legionella survives mainly in hot water** (at around 80 degrees Celsius, although most pathogens can be killed at 60 Celcius) and **cannot be part of the respiratory tract flora**. It has also adapted to **very cold** temperatures and can be found in air-conditioning systems therefore, spreading it via droplets.*

Culturing of this organism isn't available in many parts of the world including Jordan . Only a few specialists can culture it.
There is no vaccine and only a certain type of antibodies can successfully cure the patient. Sometimes to detect such a type of organism during the diagnosis we have to increase the number of antibodies 4 folds so the we succeed or using PCR.

IV. **Spirochetes:** it's a **long, spiral, coiled form** of bacteria that causes **STD**s such as Syphilis, as well as non-specific fever (of unknown origin) or recurrence of fever. Spirochetes can either be related to humans or

animals. There are also some pathogenic and non-pathognic Spirochetes.

This bacteria lacks a cell wall and instead has a special layer of lipoproteins with phosphate. This protects the protein and **allows it to "coil", the number of coils varies among species.** There is also a sheet that is wrapped around the cell body, and is responsible of attachment along with inflammatory reactions.

-**Treponema Pallidum Spirochetes:** some of them are part of the **normal flora of the oral cavity,** others affect the genital tract causing **Syphilis (STD).** Syphilis, when untreated is a very devastating disease which damages all parts of the body. Accidental contamination can cause lesions in the oral cavity. This organism is **highly susceptible to environmental factors**, meaning that it can't live outside the body for more than a few minutes and this is why this organism can not infect people by other means than close sexual contact.

Infection has *3* important stages:

- Primary Syphilis: formation of extra **genital lesions** in the superficial layers of the skin (extra genitalia). This can be easily recognized and is a simple inflammatory reaction in the sub-coetaneous tissue of the skin. It persists for 1-2 weeks then disappears.
  Here, the transmission of the sickness is very high (highly contagious through sexual contact).
- Secondary Syphils: occurs if the disease is left untreated in case of primary syphilis. Here, more of the organism is present in the genital tract and reaches the blood stream.
  *Note: Primary and Secondary syphilis in pregnant women can cause congenital Syphilis, which is very serious. The child will suffer from organ damage in the oral cavity & CNS.
- Tertiary syphilis: occurs when the disease is *still left untreated in the secondary syphilis*. The patient will suffer from more immunological

reactions associated with more damage to the CNS, bones, internal organs, and formation of granuloma and damaged tissues. **This stage cannot be cured, the patient will eventually die due to complications specially in CNS .**

The only way to diagnose Syphilis is by recognizing the extra-genital lesions ; easier in men than women, and by detecting Spirochets via dark field microscopy to recognize the movement of spirochetes . Serological tests are also used to detects specific antibodies (after 4 weeks of infection).
BDRL tests are also used to detect the disease, later confirmed by another fluorescent antibody absorption test *or by syphilis agglutination test so you can not rely on BDRL to diagnose syphilis because it might give positive result for other types of bacteria this is why you should use another test to confirm* syphilis.
Syphilis in Jordan: it is not common and we have only few cases and the actual number is unknown.