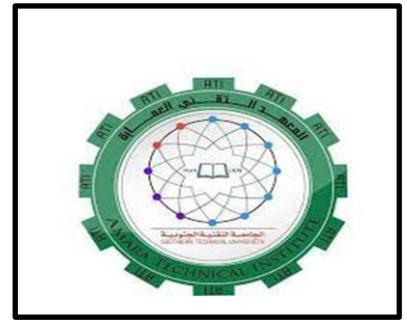




**Southern Technical University**  
**Technical institute of Amara**



**Department of Nursing Technology**

**first class**

**MICROBIOLOGY**

**done by**

**Dr. Mahdi Sayid Shekhenib**

**Microbiology** : The Science of Microbiology is the study of microorganisms and their activities. It is concerned with their form, structure ,reproduction , physiology , metabolism and identification , the distribution in nature their relationship each other and with other living organisms .

**Living cells characteristics :**

All biological system ( all living cells) have the following .

1. The ability to reproduce .
2. The ability to ingest food substances and metabolize the for energy and growth
3. The ability to excrete waste product .
4. The ability to react to changes in their environment .
5. Susceptibility to mutation .

**Distribution of microorganisms in nature**

Microorganism occur near every where in nature are carried by air currents from the earths surface to the upper atmosphere they are found in the lacks; they are found on the surface of our bodies, in all our tissues and in our mouth , nose , and other body opening .

**Medical Microbiology :**

Is the study of micro-organism that play a role in human infection by causing disease and pathogenic effect include ( bacteria , viruses, protozoa ) .The microbiology is divided into many branches on base of application of micro-organism

The microbiology is divided in to many branches on base of application of microorganism

1. Air microbiology .
2. Milk and food microbiology
3. Soil microbiology
4. space microbiology.
5. coal and petroleum microbiology
6. microbiology of water and sewage .
7. microbiology of insects .
8. medical microbiology.

### **The microscopic Observation of microorganisms .**

Microscope , the most characteristic instrument of microbiology laboratory, provides the magnification which an able one to see organisms and structure invisible to the naked eye. microscope are available which permit a wide range of magnifications from a few hundred times to hundred thousand of times .

**Protista:** the kingdom of micro-organism is divided into:-

1. Higher protista : cell are Eukaryotic .example : algae , fungi , protozoa
2. Lower protista-cell are prokaryotic . example : Bacteria , blue- green algae and viruses

### **Prokaryotic cell structure .**

1. primitive nucleus (no nuclear membrane) .
2. Nuclear division less complex than mitosis .
3. contain peptidoglycan can in cell wall .
4. Gene organization less defined than Eukaryotic .

## Group of protista

1. **Bacteria** : unicellular microscope organism .
2. **Viruses** : very small , filter passing obligate intracellular parasite . pathogen for human , Animal , plant . visible and study by electron- microscope.
3. **Algae** : simple plants, most unicellular , contain chlorophyll found in aquatic environment or damp soil .
4. **Fungi** : Plants without chlorophyll , usually multicellular .but not differentiated in to roots, stems , and leaves , reproduce by fission , budding or by means of spores borne on fruiting structure .Some cause disease to human , animal and plant . Fungi divided in to (yeasts and moulds ).
5. **protozoa**: A single cell animal , classify on the base of morphological , nutritional and physiological characteristics . cause disease for human and animals .

## **The differences between prokaryotic and Eukaryotic cell .**

<i>Character</i>	<i>pro.cell</i>	<i>Eu-cell</i>
1. cell wall pepdioglycan	yes	No
2. Cell membrane	No usually	Yes
3. mesosome	Yes	No
DNA complex with histon	No	Yes
Cell division		
a. mitosis	No but contain Binary division	Yes
b. miosis “sexual”	No	Yes
Chromosomes	single	double helix
Cytoplasm organelles		
a. mitochondria	No	Yes
b. chloroplast	No	

## **Bacteria**

Bacteria live every where most of them are saprophytes [ Live on dead organic material] . present in soil and water . all bacteria are unicellular , very small in size about 0.5-1.5um and vary in shape (cell wall of bacteria gives it's shape).

### **Type of bacteria according to shape.**

1. **Coccus bacteria** : OO singular cocci diameter 0.8-1um .

Like: A- Staphylococcus : irregular clusters Staphylococcus aureus +ve

- Streptococcus: chain like

Streptococcus viridans +ve

B. Diplococcus: pairs of cells

Diplococcus pneumonia

C. Tetrad : four of cells arranged as square

D. Sarccina : cubical arrangement with 8 cells or more .

E. Neisseria: kidney shape .

2. **Bacillus bacteria** : short Bacillus

Long bacillus

Like- mycobacterium Tuberculosis

1. Vibraio : comma shape like vibrio cholera

2. Spirochaete : Spirale

Like Treponema pallidum cause syphilis .

## **The structure of bacteria**

### **1- cell wall :**

All bacteria species are surrounded by a rigid mucopeptid .

The function of the cell wall are .

A: give the shape of bacteria .

B. support and protection of internal structure .

C. Antigenic determinants .

**Bacterial cell are divided in two groups according to chemical structure of cell wall .**

**1. Gram positive bacteria . G +ve.**

**2. Gram negative bacteria. G-ve.**

Gram positive bacteria : G +ve bacteria have cell wall thicker than G-ve bacteria ?

Because G +ve bacteria cell wall contain more peplidoglycone .

1 - G +ve bacteria: purple blue in color because it is contain less Lipid (4-11%).

There four it takes the first color stain .

2- Gram Negative bacteria : G-ve bacteria

Some bacteria contain mycolic acid such as mycobacterium tuberculosis.

G-ve bacteria : Red in color because contain more Lipid in cell wall (11-22%) so it takes the second stain .

**All bacteria cell wall have autolysis enzyme that dissolve the peptidoglycan layer is essential for .**

1-cell wall growth

2-cell septation

3- sporulation

4-Trans formation.

## Cytoplasmic membrane

Is Located under cell wall, it composed from phospholipid and protein .

### The function of it are:

- 1-Selective permeability .
- 2-bacterial electron transport .
- 3-Enzyme biosynthesis activity .
- 4- mesosome (an in fold of the outer membrane for respiration ) .

**B: Capsule :** ( the external structure include capsule , flagella and pili ).

Some bacteria have a mucous capsule around the cell wall example: klebsiella capsule can be Seen by light microscope after special stain of capsule.

### The function of capsule:

- 1- Protection: prevent drying of bacteria by binding with water molecules .
- 2-inhibit bacteriophage attachment .
- 3-Antiphagocytosis /in hibit engulfment of bacteria by white blood cell .
  1. Virulence , bacteria that contain capsule more virulent than bacteria don't have capsule .

C// Flagella: It's helical appendage originated from cytoplasmic membrane .

1.all bacteria have flagella are motile except spirochetes Lack of external flagella but are motile .

D. Some species example Nisseria gonorrhoea have hair like processes .

Called Pill

1. Sex pilus : serve as part of entry of genetic material during bacterial meeting.
2. Attachment to host cell , play role in infection.

Pili are shorter than flagella as well as it is more than flagella in number .

The differences between prokaryotic and Eukaryotic .

Character		Pro-cell	Eu-cell
1	Cell wall "peptidoglycan"	Yes	No
2	Mesosome	Yes	No
3	DNA complex with histon	No	Yes
4	Cell division by miosis "sexual"		
5	Chromosomes	Single	Double
6	Mitochondria	No	Yes
7	Chloroplast	No	yes

### **Cytoplasmic components :**

The cytoplasm of bacteria contain

- 1- **DNA " nucleic acid "** .In bacterial cell concentrated in the cytoplasm nucloid consist of haploid stranded circular convantly closed DNA molecule in many bacteria a small portion of DNA persist as **Plasmids** .
- 2- **Ribosomes :** for protein synthesis " are a complex globular structure of several RNA molecule as the active centers for protein synthesis .
- 3- **Storage granules :** hold excess metabolism .

## Bacterial spores

Round or oval structure produce by some bacteria in many species of bacteria spore formation occur under unsuitable condition one spore from bacterial cell wall . Example ( bacillus , clostridium).

There are two types of bacterial spores

- 1- **Endospores** . from inside the bacteria cells . The shape and site of the spore different according to the species of bacteria :A- Centrally located B – Terminally located C- Sub terminally.

The endospores has highly resistance for dry , dyes , radiation , temperature and boiling because :

- 1- Low content of water :
- 2- High content of Dipicolinic acid ( DPA).

The last form complex with  $Ca^{++}$  Ions this complex highly resistance .

- 3- **Exospores** : from extracellular , less resistance than endospores due to low content of (DPA).

## **Environmental factors that influence microbial growth**

**1- temperature :** All chemical reaction in the cell influence by temperature the range of temperature for microbial growth can be express as three types :

**A- The minimum temperature :** is the lowest temperature its activities are inhibited

**B- : The maximum temperature :** is the highest temperature at which growth and metabolism can proceed if the temperature rise the enzyme and nucleic will eventually become in activated and the cell die .

**C- The optimum temperature :** converse a small range intermediate between the minimum and maximum which promotes the faster rate of growth and metabolism the terms used for these ecological group are :

**1- Psychrophilic :** microorganisms grow best below 15c

**2- Mesophilic** : microorganisms grow best between 20- 40 c

**3- Thermophilic** : microorganisms grow best greater than 45c

Most human pathogens have optimum temperature (37c).

## **2- Gas requirements ( oxygen and carbon dioxide ).**

The atmospheric gases that most influence microbial growth are oxygen and co<sub>2</sub>. Oxygen has the great test effect on microbial growth play role not only as important respiratory gas but it is also a powerful oxidizing agent that exists in many toxic forms with respect to oxygen requirements several general categories are recognized .

**A- aerobic.** Grow well in the presence of normal atmospheric oxygen and posses the enzyme needed to process toxic products .Example Shigella spp .  
mycobacterium .

**B- Obligate aerobic** . microorganisms that cannot grow without oxygen .

**C- Facultative anaerobic** can grow in presence and absence of oxygen .

**D- Microaerophilic** . microorganism cant grow at normal atmospheric tensions of oxygen but requires a small amount of it in metabolism .

**E- An aerobic microorganism** doesn't grow in normal atmosphere .Example:  
Clostridium tetani , Treponema palladium .

**F- Canophilic** . grow best at a higher co<sub>2</sub> tension than normally in the atmosphere.

## **3- Light**

Darkness is favorable condition for growth of bacteria and direct sun light cause injury and killing of bacteria and another factor sun light such as ultra violet ray ( U.V. Rays).

**4- moisture** . Bacteria require water for their growth dehydration may kill most of bacteria because the water is very important for bacterial metabolism .

**5- Osmotic pressure** : bacteria are usually resistant to change of osmotic pressure but it cant resist to highly concentrated media such as ,Jam, salted meat .

**6- Suitable PH:** bacteria vary widely I n their tolerance of acidic or alkaline condition ranging from ph 4-9 human pathogens generally prefer ph with in the rang 7.2- 7.6 . but there are exception Vibrio cholera , Lactobacilli . grow best at ph 4.

### **Hydrogen Ion concentration (PH).**

- 1-** The bacteria growth well at optimum ph ,so some bacteria grow in ph (8- 10.5) this called **Alkalophilic bacteria** .
- 2- Neutrophilic bacteria** .most of bacteria grow better at a neutral to slightly alkaline ph ( 7.2- 7.6).
- 3- Acidophilic bacteria** : Grow in acidic ph Lactobacillus about ( 3-4.5)ph.

## Preparation for light microscope examination

Two techniques are employed to provide material suitable for microscopic examination :

### 1- The wet amount preparation :

Permit examination in a normal living condition suspended in fluid .wet preparation are made by placing a drop of the fluid containing the organisms on a glass slide and covering the drop with a cover slip ,the method permits examination of organisms in normal living condition suspended in fluid ( hanging drop method preparation ).

Are made by placing a drop of the bacteria suspension on a cover slip and inverting it over the concave area of a hollow ground slide .used for detection of the motility of bacteria .

### 2- **Fixed stained smears ( preparation )**

Fixed stain preparation are most frequently used for the observation of the morphological characteristics of bacteria . The advantages of this procedure are that :

- 1- the cells are made more clearly visible after they are colored .
- 2- Differences between cells of different species and within the same species .

The essential step in the preparation of affixed stained smear are :

- a- preparation of the film or smear .

- b- fixation the film on the glass slid by heat .
- c- Application of one or more staining solution .

### **Microbial stains :**

A large number of colored organic ( dyes ) are available for staining microorganism the dyes are acidic , basic or neutral dyes .the process of staining may involve ion exchange reaction between the stain and active site at the surface or within the cell .

The exchange can be represented by the following equation.



(MB mean ) methylene blue dye.

Staining method include

#### **1- Simple staining method**

#### **2- Gram staining method and fast staining method**

Simple staining method the coloration of bacteria by application of a single solution of stain of affixed smear is termed simple staining .

Procedure of the method include the following steps

- a- the fixed film is flooded with dye solution for 1 minute (example methylen blue solution dye ).
- b- The slid washed by water and then blatted to dry
- c- Examine under 100x power . Result :the microbial cell stain uniformly blue.

#### **3- Differential staining technique.**

Staining procedure that elicit difference between bacterial cells or parts of bacteria cell are termed differential staining techniques .The cell may be exposed to more than one dye solution staining regard.

#### **A- Gram staining method**

One of the most important and widely used differential staining techniques in

Microbiology is gram staining in the process the fixed bacterial smear is subjected to the following solution crystal violet , Iodine solution , alcohol( decolorizing agent ) and safranin or the suitable counter stain the steps of the gram stain include

- 1- fix smear by heat
- 2- cover with crystal violet for one minute
- 3- wash by water don't blot
- 4- cover with iodine for one minute
- 5- wash by water
- 6- Decolorized for 10 -30 sec with alcohol
- 7- Wash by water
- 8- Cover for 10- 30 sec with safranin
- 9- Examine under 100 power .

**B- Acid – fast stain (Ziehl- nielsen stain ).**

- 1- fix smear by heat
- 2- cover with carbol fuchsin , steam gently for 5 minutes over direct flame ,don't dry or boiling.
- 3- Wash with water
- 4- Decolorize in H<sub>2</sub>so<sub>4</sub>( 20%).until only a fain pink color remain
- 5- Repeat 3 and 4 steps 3 times wash with water
- 6- Counter stain for 10 -30 sec with methylen blue
- 7- Wash with water and then let to dry and examination under 100 x

-**Sterilization** :It's killing or remove all living microorganism either in vegetative or spore state .

- **Disinfection**: It is a process of destruction of pathogenic organism but not spores.

**-Bacteristatic agent:** Only prevent multiplication of bacteria and they may remain alive inhibit like tetracycline

**-Bactericidal agent:** Any agent that able to kill the bacteria like penicillin.

**There are two method of sterilization .**

A/ physical            B/ Chemical

**A/ physical sterilization.**

Methods in which no chemical substance is used include:

1. Thermal method    B-not thermal method.

**Thermal method :** the metabolic activity of an organisms are the result of chemical reactions and since chemical reaction are influenced by temperature it follow that the life process of organisms are also influenced by temperature. Heat is one of the most effective reliable and economic sterilization agent widely used. temperature above a maximum will exert a killing effects where as temperature below minimum are regarded as producing a static effect .

Vegetative cells can be killed at temperature 50-60c but a much higher temperature is required to kill spores .

Example :Yeast cells , vegetative cell kill by 50-60 at 10 minutes, spore killed by 70-80c for 10 minutes moist heat more active than dry heat because it is denaturation of the cellar protein .

Example: spores of clostridium botulinum are killed in 120c by moist heat for 5 minutes where as it needed to two hours at 120c in dry heat.

**Dry heat.**

1. **Incineration:** the actual burning of material destroying microorganisms and the method used for .

A- Infected Laboratories animals .

B- Contaminated clothes and materials .

2. **Flaming** : Sterilization the platinum wire of the loop and mouth of tubes .
3. **hot air oven 160-220c sterilization**. Destroyed by dry heat only when exposed to extremely high temperature for long period of time effect of dry heat that destroy microorganisms through oxidation , of their intracellular constituent use in sterilization of Laboratory glass ( Petri dishes) .

B - **moist heat** this is much efficient than dry heat method because the moist heat .penetrate easier destruction and coagulation of protein .

1. **Boiling** to kill all vegetative bacteria, fungi ,virus that contaminated material will destroyed with in minutes by exposure to boiling water spore not killing by this method.
2. **Pasteurization** : to kill most of the pathogenic bacteria 62c for 30 minutes used to sterilization of milk/ cream / alcohol .
3. **fractional sterilization (tyndalization)** use for sterilization of some substances, bacteriological media and chemical that effected by high temperature 100c.

Expose the material to a temperature below boiling temperature (60-70c) for ½ hour for 3 days in this days the temperature kill the vegetative cells only (not the spore) when the material cool to the room temperature the spore convert to vegetative cell which will die during heating in the second day the heating in third day is to be sure to get astral material .

4. **steam under pressure heat** in the form of saturated stem under pressure is the most practical and dependable agent for sterilization steam under pressure provides temperature above those obtained by boiling the advantages are .
  - a. rapid heating b- penetration.
  - c. moisture in a abundance which facilitate the coagulation of proteins the Laboratory apparatus designed to use steam under pressure is called auto clave use for sterilization of media. The time of sterilization depend on the type of nature of container nature and

material being sterilized Example: media in test tubes require 10 minute , but media in bottle 10 liter quantity require one hours.

## 2. not thermal method

### A. Radiation.

1. **ultra violet radiation** : it has lethal effect on bacteria because it is absorbed in the nucleic acid of the bacteria also forms ozone gas ( $O_3$ ) in the air and hydrogen peroxide  $H_2O_2$  un the water which kill bacteria it is used to sterilized laboratories and operation rooms , it can not penetrate the glasses.

### 2. Ionizing radiation.

Ex: Gamma- rays , it penetrate deeper than ultra violet it is used to sterilized. Syringe and threads which is used in the operation .

B. **Filtration** : by using filters which has a very small pores which prevent the passage of bacteria through it , It used for sterilization media and biological solution which effected by thermal method .

## Chemical sterilization

1. **salts** : used in high concentration as bacteria static .

Ex: NACL is used for preservation of meat and fishes .

2. **Acid and Base** : bacteria grow in a natural media and it can not grow in acidic or basic medium , so the acid and base used to stop the growth of bacteria .

Ex: acetic acid , benzoic acid are used in preservation of food .

3. **Halogen:**

a. **chlorine** : it is used 1-2 ppm to kill the bacteria in water .

b. **Iodine**: it is used in a concentration of 2-5% in water or 1-2% in alcohol to disinfect the wounds.

4. **Alcohols** Ex: Ethyl alcohol in concentration 70% kill a high numbers of pathogenic bacteria.

#### 5. **Gaseous disinfectant.**

Formaldehyde (37% a quos solution called formalin) is disinfectant , but it has an irritating audar .

6. **days** : a number of days are toxic to microbe and able to inhibit the growth of bacteria (gram +ve) bacteria more sensitive to day than gram -ve

7. **surface – active substance** : soap and fatty acids change the bacteria cells negative charge and acquire positive charge with impairs the normal formation of cytoplasm membrane the substance not penetrate into the cells.

**Medical microbiology .**

**Medical bacteria :**

\* **Pathogens** : Is the micro-organisms that can cause disease to the host ( **human** or **animal** )

- **Non pathogen** : micro-organisms not capable causing disease .
- **Carrier** : a person or animal with asymptomatic infection that can be transmitted to another susceptible person or animal.

**Infection** : multiplication of an infection agent within the body of the host invasion the process where by bacteria , animal parasites , fungi and viruses , enter host cells or tissues and spread in the body .

**Virulence** : the quantitative ability of an agent to cause disease .

*The degree of virulence depend on the following :*

**1. Surface components :**

**A. Capsule** , help to increase the resistance of bacteria to phagocytosis and resist the action of bactericidal substance in the body fluid Example : pneumonia disease cause by *pneumococci SPP*.

**B. M-protein** , some species of bacteria have a layer of "polysaccharide" outside their cell wall increase the pathogenicity of bacteria. Example : *Enterobacteriace* .

**2. Adherence to the surface** : (adhesion , attachment ) the process by which bacteria stick to the surface of host cell once bacteria have entered the body adherence is a major initial step in the inflammation process .Example : pili .

**3. Toxin production** : ( Toxogenicity ): toxins produced by bacteria are generally classified into two groups :

**A: Exotoxins** : Secreted by living growth positive bacteria Example : tetanus disease caused by toxics of *clostridium titan* and it divided to :

1- Cytotoxins 2- Neurotoxins 3- Enterotoxin .

**B. Endotoxins** : Excreted by gram Negative bacteria (**G+**) after death of bacteria: Example bacillary dysentery cause by *shigella spp*. Enteric fever cause by *Salmonella spp*.

**Toxemia** : production of toxins by bacteria to the blood and to all parts of the body of host .

*Pathogenicity and virulence of micro-organism depend on the following factors :*

1.Toxins and enzymes .

2. Number of bacteria .

3. Types of infected tissues .

4. Age and resistance (immunity)

**The Rout of infections.**

1-Skin and mucous membrane

2- Lungs (Respiratory tract).

3-Gastro-intestinal tract.

4- Uro-genital system .

## ***Staphylococcus : SPP***

**Morphology** : it's a G+ve bacteria , cocci , non motile , non capsulated , non spore, growth at 37C° on most bacteriological forming catalase +ve and arranged in cluster .

**Species:** Staphylococcus divided in to 3. groups according to the pigment production :

1. *Staphylococcus aureus* (coagulase +ve) : Produce golden yellow colonies on nutrient agar and it is pathogenic.



2. **Deep infection** : Tonsillitis , pharyngitis , acute osteomyelitis
3. **Staphylococcal food poisoning** : Food which contaminated by entero toxin of bacteria staphylococci, for example : Milk, fish and meat .

## ***Streptococcus SPP.***

### **General Characters :**

1. Gram +ve , cocci bacteria , arranged in chains
2. Non motile .
3. Non spore forming , catalase -ve (Bio-chemical test ).
4. Aerobic or facultative anaerobic.
5. Some time capsulated.

*The classification on the base of hemolytic.*

Streptococci divided according to their haemolytic activity in to :

1. **α (Alpha) hemolytic** . produce a green zone around the colony as a result of incomplete lysis of red blood cells . Example: *Streptococcus viridance*
2. **β (Beta) hemolytic** from a clear zone around their colonies as a result of complete lysis of red Blood cells . Example : *Streptococcus pyogenes*
3. **γ (Gamma) hemolytic** : non hemolytic. Example : *Streptococcus faecalis* .

### **Pathogenicity :**

#### **1. Streptococcus pyogen :**

- Respiratory system infection : sorethroat and tonsillitis .
- Scarlet fever : Erythrogenic rash.

- Skin infection : wound and burns .
- Rheumatic fever .
- Genital tract.

2. **Streptococcus viridans** : cause subacute of endocarditis.

3. **Streptococcus faecalis** : cause urinary tract infection in the case of contamination.

**Genus Neisseria .**

**General characters :**

1. G-ve .
2. cocci bacteria.
3. arranged in diplococci.
4. non spore former.
5. Aerobic
6. it's requires blood or serum addition to agar and 8-10%  $\text{CO}_2$  .

*There are two important pathogenic species :*

**1. *Neisseria meningitides***

Which cause meningitis also called meningococci.

Diagnosis by .

- a. Smear from nasopharynxon Blood agar .
- b. Cerebro- spinal fluid
- c. Rout of infection from Aerosol inhalation

**Pathogenicity:**

It cause cerebrospinal meningitis and meningococcal septicemia .

## 2. *Neisseria gonorrhoeae*

General characters :

1. G-ve , cocci .
2. aerobic , require 5-10% Co<sub>2</sub> and an enriched media .

also called gonococci cause Disease is called "Gonorrhoea" .

**Habitat** : infected urethra and prostate and tests in man . in female infection cervix, urethra.

**The route of infection : sexual .**

All *Neisseria* are oxidase +ve .

**N. catarrhalis.**

**N. pharyngis .**

**Diagnosis** - urethra discharge }  
                  Cervix discharge } dry preparation  
                  Or pus } G-ve

2. culture → Blood agar.

This bacteria can be seen inside the white Blood cell .

***Mycobacterium***

***Mycobacterium tuberculosis***

**The characteristics:**

1. A thin bacilli with diameter about 1/2 micrometer and with 1-5µ in length
2. contain granules with dark colour than the color of bacilli body that give beaded shape of it.
3. Non capsulated , Non spore forming .

**The types :** there are several types *of mycobacterium tuberculosis* .

1. Human type } infected the human
2. Bovine type }
3. Avium type
4. murine type
5. piscine type `

## **The Location and transmission .**

1. The human type transmitted by patient air sole with sneezing and cough .
2. Bur the bovine type transmitted by drinking of contaminated milk with bacilli ( bovine type also by patient airsole .

## **The Diseases :**

1. Human type caused "pulmonary tuberculosis.
2. Bovine type cause "military tuberculosis ; that act by .
  - a. Lymph node t.b (tuberculosis).
  - b. Bone and joint T.b (=).
  - c. Urinary and genital tuberculosis (T.B).
  - d. Meningal (T.B).

## **Diagnosis:**

Diagnostic laboratory test .

Specimens include (fresh sputum, gastric washing)

3. make culture and smearing from specimen
4. sensitivity test .

*Mycobacterium tuberculosis*

*Mycobacterium lepra*

## *Clostridium SPP*

### **General characteristics :**

1. G +ve rods , large
2. Anaerobic
3. Motile and
4. Spore forming
5. Decompose proteins or form toxins , some are both .

### **Habitat :**

Natural habitat in the soil or the intestinal tract of animals and humans .

### **Disease :**

Causing disease like :

1. Botulism Cl. Botulinum
2. Tetanus
3. Gas gangrene
4. pseudo – membranous colitis .

### ***Clostridium tetani***

Cause the disease is called " **Tetanus** "

#### **The distribution :**

Is world wide distribution in the soil and in the feces of horses and other animals .

#### **Pathogenisity :**

There are several types of *Clostridium tetani* can be distinguished by specific flagellar antigens produce some toxins like neurotoxin and Tetanospasmin .

#### **Preventions :**

1. Active immunization with toxoids .
2. proper care of wounds contaminated with soil .
3. Prophylactic (prevention) use of antitoxin .
4. Administration of penicillin .

The factors that predispose the wound infection with *Clostridium . tetani*

The infection remains strictly Localized in the area of devitalized tissue ( wound , burn , injury, umbilical stamp and surgical suture .

The germination of the spore and development of vegetative organisms (**that produce toxin**) are aided by :-

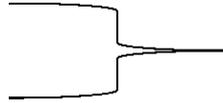
1. Necrotic tissue .
2. Calcium salts .
3. Associated with pyogenic infection .

All of which aid establishment of low oxidation reduction potential .

### ***Clostridium perfringens* ( welchii )**

## *Clostridium* Oedemation

## *Clostridium* Septicum



other type that cause Gas gangrene

### **General characters :**

1. G+ve anaerobic 2. motile 3. rod bacteria. 4. spore forming 5. Not form spore when grow in Laboratory media. 6. contain capsule .

### **Disease :**

1. myonecrosis 2. Gas gangrene 3. Food poisoning .

## *Clostridium botulinum*

### **General characters :**

1. G+ve bacilli
2. spore forming , spore is located terminal.

### **Toxins :**

That release many types of toxins like A,B,C ,D,E,G and F . the toxins A, Band F that principle cause the food poisoning of human .

## **Bacillus anthracis**

General characters :

1. G+v rods have square ends and arranged in long chain .
2. Capsulated .
3. Large aerobic
4. Spore forming , spores maybe central , subterminal or terminal depending on the species

### **Diseases :**

The disease of this bacteria is called " **anthrax** "

## ***Enterobacteriaceae***

### **The characteristics :**

1. All of them are bacilli or rods .
2. G-ve stain .
3. Grow on simple ordinary media.
4. Found in digestive system .
5. Aerobic and facultative anaerobic .
6. Non sporulated and grow in temperature about **37C°**.

The pathogenic bacteria cause disease in man and animal are :

1. Escherichia     SPP
2. Salmonella     SPP
3. Shigella     SPP
4. Klebsiella     SPP

## **Escherichia   Coli**

### **The morphology and occurrence :**

1. G-ve     2. Motile     3. non sporulated     4. aerobic     5. few of them are capsulated
6. usually found in the large intestine in man and animals and also found in soil and water specially stagnant water .

### **The culture and biochemical :**

1. E. Coli can grow in simple media and solid media after 24 hrs of incubation and give or produce convex smooth circular colonies and on the macchony agar produce pink colour because it Lactose fermented gives in dole positive test .

### **There are five pathogenic types of E. Coli.**

1. Entro pathogenic     E. Coli
2. Entro toxigenic     E. Coli
- 3 Entro invasive     E. Coli
4. Entro hemorrhagic     E. Coli
5. Entro aggregative     E. Coli

## The Disease :

1. Summer diarrhea .
2. urinary tract infection
3. Acute Gastro-enteritis in infant .
4. Peritonitis .

## SalmonellaSPP

الاسبوع الحادي عشر

### General characteristics :

1. Most of them are pathogenic and few of them are non pathogenic .
2. G-ve rod bacteria .
3. Non lactose fermented .
4. motile .

### Occurance :

Salmonella . found in the intestine of man and animals , found soil and stagnant water specially near the animals farmers .

### Culture and biochemical test :

1. on solid media they produce round smooth colonies .
2. In fluid media they produce turbidity , for there isolation we need selective media .  
(s.s.agar) ( salmonella –shigella agar).

### The types of Salmonella :

- |                      |                    |   |                |
|----------------------|--------------------|---|----------------|
| 1. <u>Salmonella</u> | <u>typhi</u>       | } | Enteric fever  |
| 2. <u>Salmonella</u> | <u>paratyphi</u>   |   |                |
| 3. <u>Salmonella</u> | <u>typhimurium</u> |   |                |
| 4. <u>Salmonella</u> | <u>enteriditis</u> | } | food poisoning |

\*The Disease that cause by salmonella bacteria

1. Typhoid fever . S. typhi enteric fever
2. paratyphoid fever cause by S. paratyphi
3. Food poisoning cause by all salmonella SPP .

**Symptoms :**

1. Vomiting and abdominal pain
2. Headache
3. Gastroenteritis .

**Rout of infection :**

1. Drinking of water and milk that contaminated with feces .
2. Carriers .

**Diagnosis :**

1. Widal test .Antigen antibody reaction .
2. 2-3-4 weak culture of feces urine.

الاسبوع الثاني عشر

**\* Shigells SPP****General Characteristics :**

- 1.G-Ve bacilli, non motile , non sporulation .
2. Non Lactose Fermenter .
3. urease – ve

**Habitat :** Found natural habitat in intestine of human and monkey .

The types:

1. shigella dysenteriae
- 2 shigella flexneri (group B)
3. shigella bodyii (Group c)
4. shigella sonnei (Group D).

Symptoms :1- fever 2- abdominal pain 3-watery diarrhea with blood or mucous or pus .

\* *Proteus*

**General characters :**

1. G-ve rod bacteria.
2. non lactose fermenter.
3. actively motile .
4. when grown on solid media produce **swarming** .
5. Culture of it produce a specific odor . ( **rotten fish** ) .

**Habitat :**

Found in intestine of man , animal , contaminate soil and stagnant water .

**Types :**

- 1- Proteus vulgaris
2. Proteus mirabilis
3. Proteu morganii.
4. Proteu rettgeri .

**Diseases :**

1. Otitis media .
2. Urinary tract infection .
3. Contamination of burns .
4. Gastroenteritis .

- *Brucella*

**Morphology and characteristics :**

1. G-ve bacteria. 2. Cocco bacilli. 3. Obligate parasites of animals and human and located intracellular ( **Habitat** ). 4. Aerobic. 5. non motile. 6. Non capsulated. 7. non sporulated

**Rout of infection :**

1. Mouth orally
2. Inhalation

**Types :**

1. Brucella metitensis : infect goat and sheep .
- 2 . Brucella abortus : infect cattle 5-10 %  $\text{CO}_2$

3. Brucella suis : infect pigs.

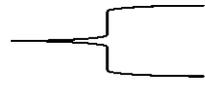
Transmission to human during drinking of milk, and inhalation .

**Disease :**

Brucellosis ( **Malta fever** ) .

**Diagnosis :**

1. Take specimens , blood should be taken for culture .
2. Biopsy material for culture ( Lymph nodes ) .
3. Serum for serological tests .

- 
- a. Rose Bengal test
  - b. Tube agglutination test

4. Intradermail Brucellin test .

- *Bordetella spp*

Brodella pertussis

**Morphology and culture :**

1. G-ve cocccbacilli .
2. with toludine blue stain , bipolar metachromatic granules can be demonstrated .
3. Capsule is present .
4. The bordello cultured on enriched media Bordet –Gengou , media) produce small faintly G-ve rods , non motile .

**Disease :**

Whooping cough .

**Types :**

1. Bordetella pertussis
2. Bordetella Bronchiseptica
3. Bordetella parapertussis

\* *Vibrio cholera*

- Vibrio cholera : **Non haemolytic**
- Vibrio cholera : **Haemolytic (El-tor)**

**Morphology :**

1.G-ve bacteria 2.Comma-shaped 3.curved rod 4.Actively motile 5.Flagella 6.

Produce convex, smooth , round colonies that are opaque and granular in transmitted light

**Disease :** Cholera disease .

**Diagnosis :**

1. Laboratory : by smear from stool may show rapidly motile vibrios .
2. Isolation of vibrio from stool or feces and culture on suitable media like alkaline peptone broth or **TCBS** media .

- *Spirochetes*

**Morphology :**

Long slender , helically coiled , spiral or cork screw shaped , G-ve bacilli , motile

- **Treponema**

1- Treponema pallidum

**Morphology :** Slender spiral , actively motile

**Disease :** Syphilis

**Diagnosis :**

Specimens (samples) , tissue fluid demonstration of spirochetes , blood serum for serological test .(VDRL) or wasser Mann test

1. Dark field examination (motility) " **Giemsa stain** "
2. Immuno fluorescence test "serological test .

2- Leptospira . interrogans

**Morphology and characteristics :**

1. Tightly coiled, thin flexible spirochetes , one end is often bent , forming a hook .
2. They are actively motile and aerobic bacteria .

**Rout of infection :**

contaminated water with urine infected .

**Diagnosis :**

1. Samples a. Blood b. C. S. f.
2. Dark field examination (Giemsa technique) .
3. Serological test .

**Disease :** - **Weil** disease

- Acute Junedice with bleeding from rose , lung , intestine .

## Immunity

**Immunity** : The resistance offered by the host to the harmful effect of pathogenic microbial infection .

*Types of immunity :*

**1- Natural immunity .**

**2- Acquired immunity .**

Natural or (**innate** ) immunity : basic immunity which may be genetically passed on from one generation to other generation .

**Acquired immunity** : Acquired during life time and divided to :

**1- Active** : it is the resistance developed as a result of antigenic stimulus active acquired immunity may be :

**A- Natural**

This acquired after infection .

**B- Artificial**

This acquired artificially by inoculation.

**2- Passive acquired immunity** : it may be

**A- Natural** : transmission of antibodies from the mother to the fetus can occur through placenta and breast feed .

**B- Artificial** : produce by injection of serum of animals that been immunized activity.

- **Antigen** : Protein , poly saccharide or poly peptid when introduced in to the body stimulates the production of antibody and react specifically with such antibody .
- **Antibody** : Is hormonal substance produce in response to antigenic stimulus it serve as protective agent against organism .