



**Ministry of Higher Education and Scientific
Research
Middle Technical University
Technical Institute-Baquba
Department of Nursing**

**MICROBIOLOGY
First Year**

**Dr. Laith Issa Yassin
Suhail Jawdat Fadil (Lecturer)**

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	Yes

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 co₂. 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 co₂ 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.

الاسبوع الخامس

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_2SO_4 (20%).until only a faint 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

الاسبوع السادس

-**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 cellular 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 in 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 .

الاسبوع السابع

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.

الاسبوع الثامن

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 toxins 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 .

الاسبوع التاسع

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.

3. *Staphylococcus citreus* :Produce Lemon yellow colonies on nutrient agar, it is non pathogenic.

It is often found in upper respiratory tract (nose) intestine and some times on the skin especially in hospital stuff and patients transmission by the hand , food and it can live in high concentration of salt. out side the body they could be also found in air Soil and water .

1. They are aerobic and facultative anaerobic , grow easily in nutrient broth and agar after 24 hrs of incubation in 37.

3. blood hemolysis ---- haemolysin.

5- Oxidase (- ve).

Toxins

- ### Pathogenicity :

1. Cutaneous infection : Cutaneous lesions, abscess, Boils, eye infection.

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 .

الاسبوع العاشر

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. Strepococcus 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.

الاسبوع الحادي عشر

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% CO₂ .

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_2 and an enriched media .

also called gonococci cause Disease is called "Gonorrhea" .

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 } dry preparation
Cervix discharge }
Or pus } G-ve

2. culture → Blood agar.

This bacteria can be seen inside the white Blood cell .

الاسبوع الثانى عشر

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
 2. Bovine type
 3. Avium type
 4. murine type
 5. piscine type
- } infected the human

The Location and transmission .

1. The human type transmitted by patient air sole with sneezing and cough .
2. But 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

الاسبوع الثالث عشر

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 :-

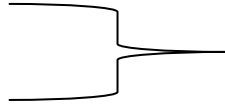
1. Necrotic tissue .
2. Calcium salts .
3. Associated with pyogenic infection .

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 macconky agar produce pink colour because it Lactose fermented gives in dole positive test .

There are five pathogenic types of E. Coli.

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

The Disease :

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

الاسبوع الخامس عشر

*** Salmonella SPP**

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> | } | food poisoning |
| 4. <u>Salmonella</u> | <u>enteriditis</u> | | |

*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 السادس 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 .

Enterobacteriaceae**The general 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. Proteus 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 :

E. Coil can grow in **simple media** and **solid media** after (24 hrs) of incubation and give or produce convex circular colonies and on the MacConky agar produce pink colour because it **Lactose** fermented gives in dole positive test .

According to the inflammation that cause , we can divide in to :

1. Enteropathogenic.
2. Enteroadhesive .
3. Entrotoxigenic .
4. Entrohaemorrhagic .

The Disease :

1. Summer diarrhea .
2. Urinary tract infection (**UTI**) .
3. Acute Gastro-enteritis in infants .
4. Peritonitis .

Diagnosis :

- a. Culture faeces (stool) in the MacConky agar.
- b. Test of lactose fermenting colonies .
- c. Serological test .

* *Salmonella*

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 .
5. Produce catalase.
6. Facultative anaerobic.

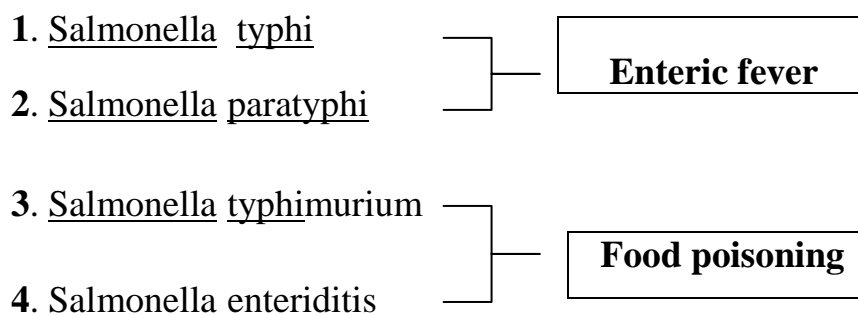
Occurance :

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

Cultural character :

1. On the MacConky, Salmonella – Shigella agar, produce **pale** and **entire** colonies.
2. On the Xylose-Lysine-Desoxycholate (**XLD**) agar, produce **red-black** colonies .
3. On the Bismth sulphate (**BS**) agar, produce black (**metallic sheen**) similar to rabbit eye.

The types of Salmonella :



* The Disease that cause by *salmonella* bacteria :

1. **Enteric fever** : Cause by *Salmonella typhi* :
2. **Paratyphoid fever** : Cause by *salmonella paratyphi*
3. **Food poisoning** : Cause by all salmonella SPP .

Symptoms :

1. Vomiting .
2. Abdominal pain .
3. Headache .
4. Gastroenteritis .

Rout of infection :

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

Diagnosis :

1. **Widal test** . (Antigen antibody reaction) . The search of the antibodies(**O,H**) in the serum of the patient .
2. Culture the blood of patient in first week .
3. (2 - 3 – 4) weak culture of feces and urine .

الاسبوع الثامن عشر

* *Shigells*

General Characteristics :

1. **G**-ve bacilli. 2. non motile . 3. non sporulation . 4. Non Lactose Fermenter . 5. urease – ve. 6. Facultative anaerobic. 7. Grow in the (**XLD**) agar and produce **red** colonies .

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

The types :

- | | | |
|--|---|--------------------------------|
| 1. <u>Shigella</u> <u>dysenteriae</u> .. | } | cause Dysentery disease |
| 2 <u>Shigella</u> <u>flexneri</u> | | |
| 3. <u>Shigella</u> <u>bodyii</u> | | |

4. Shigella sonnei

Symptoms :

- 1- Fever
- 2- Abdominal pain
- 3- Watery diarrhea with blood or mucous.

* *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 % CO_2
3. Brucella suis : infect pigs.

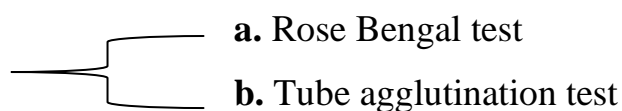
Transmission to human during drinking of milk, and inhalation .

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 .



4. Intradermail Brucellin test .

الاسبوع التاسع عشر

- *Bordetella spp*

Brodella pertussis

Morphology and culture :

1. G-ve coccobacilli .
2. with toluidine 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) " **Giensa 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 (Giensa technique) .
3. Serological test .

Disease : - **Weil** disease

- Acute Jundice with bleeding from nose , lung , intestine .

Mycology

Mycology : is the branch of biology concerned with the study of fungi, including their **genetic** and biochemical properties, their taxonomy and their use to humans as a source for tinder, medicinals (e.g., **penicillin**), food (e.g., **beer**, **wine**, **cheese**, edible mushrooms) and entheogens, as well as their dangers, such as poisoning or infection.

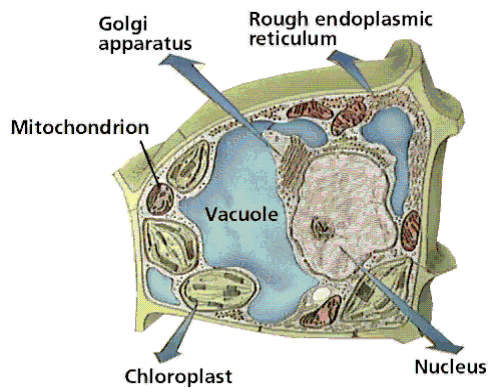
Fungi : Are plants that has lack chlorophyll and reproduced by spores .

General characteristics :

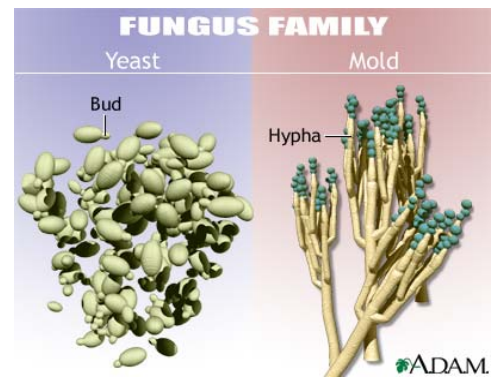
1. All fungi are **eukaryotic** organism .
2. Most Fungi are **obligate** or **facultative** aerobic .
3. Nutritional requirement to growth of fungi is simple, sometimes need enrich media .
4. Each fungal cell has at lest one **nucleus** and **nuclear membrane** , endoplasmic reticulum , mitochondria and secretory apparatus.
5. Optimum temperature of growth of fungi 28C° .
6. Growth in pH (2-9), it growth well in acidic PH .
7. Fungi may reproduced sexually or asexually
8. Fungi grow in two basic forms as **yeast** and **molds** .

Classification of fungi according to the morphology :

- 1- **Molds** :- Most fungi consist of microscopic branching filaments, called (**hyphae**).
These are normally divided septa in to cells . **e.g** : *Rhizopus*
- 2- **Yeast** :- When fungi appear **unicellular**, spherical or oval shaped and reproduce by budding are generally called yeast . . **e.g** : *Cryptococcus neoformans*



Fungi Cell



Yeast

Mold

Dimorphic fungi : The term dimorphic is used to describe a fungus which occurs in two different forms according to the environmental culture.

Appear filaments at 22C but appear yeast on the culture media at 37C or in the human body.

For example some pathogenic fungi are (**Mycelia**) in culture and yeast like in infected tissues.

A **mycosis** (plural: **Mycoses**) is a fungal infection of animals, including humans.

There are three types of mycosis :

1. Superficial mycosis: *Candida albicans*
2. Subcutaneous mycosis: *Mycetoma*
3. Systemic mycosis : *Cryptococcus*

Virus

Virus: Are unicellular ultramicroscopic particles, containing either RNA or DNA, reproducing inside living cells.

- Virus can be seen under **Electron microscope** only .



Electron microscope



Light microscope

Characters :

1. Don't possess cellular organization .
2. Contain one type of nucleic acid either RNA or DNA never both.
3. Lack enzymes necessary for protein and nucleic acid synthesis .
4. They multiply by complex process inside living cell called replication not by binary fission .

Morphology :

Viruses vary widely in size . The largest virus among them is Pox viruses measuring about **300** nM. The smallest viruses are foot and mouth virus measuring about **20** nM .

Shape :

Viruses are also widely in shape some viruses have characteristic shape like, Rabies virus has bullet shape.

Pox virus has brick shape . Influenza virus has spherical shape.

Structure :

- ✧ Viruses have a central core of nucleic acid which is either RNA or DNA but never both.
- ✧ Nucleic acid is covered by protein coat (**protein + nucleic acid**) called capsid .
- ✧ The capsid is composed of a number of subunits called nucleocapsid .

✕ The nucleocapsid is either enveloped or non enveloped .

✕ Protein subunits may be seen as projecting on the surface of the envelop these are called peplomers .

✕ Capsid are usually symmetrical in structure.

There are two types of symmetry :

1- Helical symmetry : **a - non enveloped helical .** **b - enveloped helical .**

2- Cubic symmetry cubic : **a- non enveloped cubic.** **b- enveloped cubic .**

Virus and disease

Influenza virus :

Mumps :

Small Pox :

Measle : Paramyxovirus

Poliomyelitis : Poliovirus

Adenovirus :

Hepatitis :

Rhabdovirus : rabies

A- DNA virus :

1- Herpes virus : herpes simplex

2- Pox virus : smallpox.

B- RNA virus :

1- Poliovirus : poliovirus

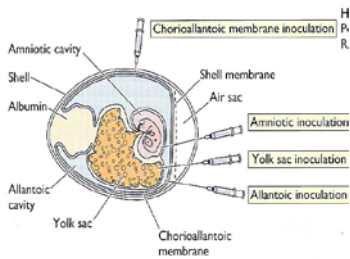
2- Paramyxovirus : measles.

3- Rhabdovirus : rabies.

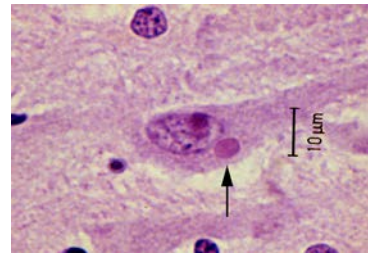
Cultivation of virus

Virus can be cultivated on :

1- Chicken embryo.



2- Tissue culture .



الاسبوع الواحد والعشرون

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 .

الاسبوع الثاني والعشرون

Parasitology

Parasitology : Is the science which deal with living organisms which live temporary or permanently on or within other organisms for the purpose of procuring food and shelter.

Medical Parasitology : Is the science which deals with the parasites which cause human infections and the diseases they produce .

Parasites : Organisms that infect other living beings. They live in or on the body of another living beings called **host** and obtain shelter and nourishment from it .

Types of Parasites :

1. **Ectoparasite (external)** : Which inhabit the body surface only, without penetrating into the tissues. Like : Lice, ticks, mites, fleas and mosquitos.
2. **Endoparasite (enternal)** : Which live within the body of the host. Like: all protozoan and helminthic parasites.
3. **Pathogenic parasites** : Which causes injury to the host by its mechanical or toxic activity .
4. **Temporary parasites** : It is free-living parasite which visite the host occasionally for obtaining the food .

- 5. Permanent parasites :** Which remain on or in the body of the host from early life until its maturity.
- 6. Facultative parasites :** Organisms which may exist in free-living state or may become parasitic living .
- 7. Obligate parasites :** It is organisms which is completely depend on the host .

The host : It is the organisms or animale which parasite live on or in it .

Types of hosts :

- 1. Definitive (final) host :** The host in which the adult stage lives or the sexual mode of reproduction takes place.
- 2. Intermedial host :** The host in which the larval stage of the parasite lives or the asexual multiplication takes place .
- 3. Reservoir host :** It is an animal that can harbor the parasite and can be potential store of infection for man .
- 4. Vector :** It is usually on arthropods (insect) that carries the parasite to its host.
There are **2** types :
 - A. Mechincal vector :** Only transport the parasite without any role of life cycle, like fly .
 - B. Biological vector :** The parasite undergo development or multiplication in the body of it.

" Host - Parasite relationship "

Symbiosis : It is relationship between parasite and host. Symiosis divided into :

- 1. Mutualism :** In which asymbiotic association is benefit to both organisms.
(flagellate in termit's intestine).

2. Commensalism : When one of the associated organism is benefit and the other is neither benefit nor affected. (*Trypanosoma musculi* live in Rat's blood) .

3. Parasitism : It is an association in which one organism depend upon another for its existence, the one organism called (parasite) and the other called (host) and usually causes harm to the host .

The parasitic disease required the following Factors:

1. Source of infection .
2. Method of transmission .
3. Suitable host
4. Presence of vectors .

الاسبوع الثالث والعشرون

General Classification of Parasite

- ✕ Medical Protozoology .
- ✕ Medical Helminthology .
- ✕ Medical Entomology .

Medical Protozoology

Parasitic protozoa

The main characteristics .

1. **Unicellular organism :** consist from :
 - a. Protoplasm consist from : (Cytoplasm + Nucleus)

b.Nucleus consist from : (Nuclear membrane + Chromatin)

2. Nutrition : by Engulfment

3. Motility . by :

a. Pseudopodia → *Entamoeba histolytica*

b. Flagella → *Giardia lamblia*

c. Cilia → *Balantidium coli*

d. Non motile → *plasmodium SPP*

4. Reproduction : By many method.

- └ A. Asexual Reproduction : Binary fission, Schizogony, Longitudinal
- └ B. sexual Reproduction .

Classification of Protozoa :

Phylum Protozoa include 4 classes due to locomotive organs .

1. Rhizopoda: move by : **pseudopodia**
2. Flagellata : move by : **flagella**
3. Ciliata move by : **cilia**
4. Sporozoa . move by : **have no locomotive organs.**

1-The class Rhizopoia :

Divided in to **4** groups due to their **locomotive organs** .

1. *Entamoeba histolytic*
2. *Entamoebia coil*
3. *Entamoebia hartmanni*
4. *Naegleria SPP* . free living amoebae.

Example : **Entamoeba histolytic**

Multiply: by binary fission .

Disease : Amoebic dysentery , Intestinal amoebiasis , Amoebic hepatitis .

Habitat : large intestine of human .

Geographical distribution : Cosmopolitaton

Morphology : two stage, **A.** Cyst → non motile . **B.** Trophozoite → motile .

Site in host : Lumen and wall of large intestine in human and Monkeys.

Source of infection : Cyst in food and water from feces of human .

Infective stage : Mature cyst with 4 nuclei .

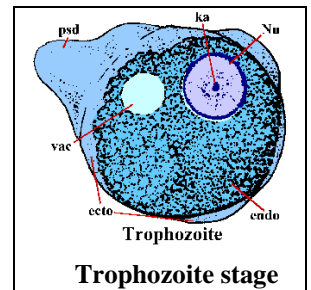
Diagnostic stage : Trophozoite and cyst .

Mode of infection : Oral route by ingestion mature cyst contaminated foods or drinks .

Morphology : Have 2 stages :

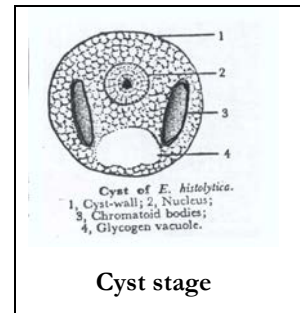
1. Trophozoite stage :

- Irregular shape.
- Cytoplasm is differentiated in to ectoplasm and endoplasm .
- Number of food vacules in the cytoplasm continig (RBC).

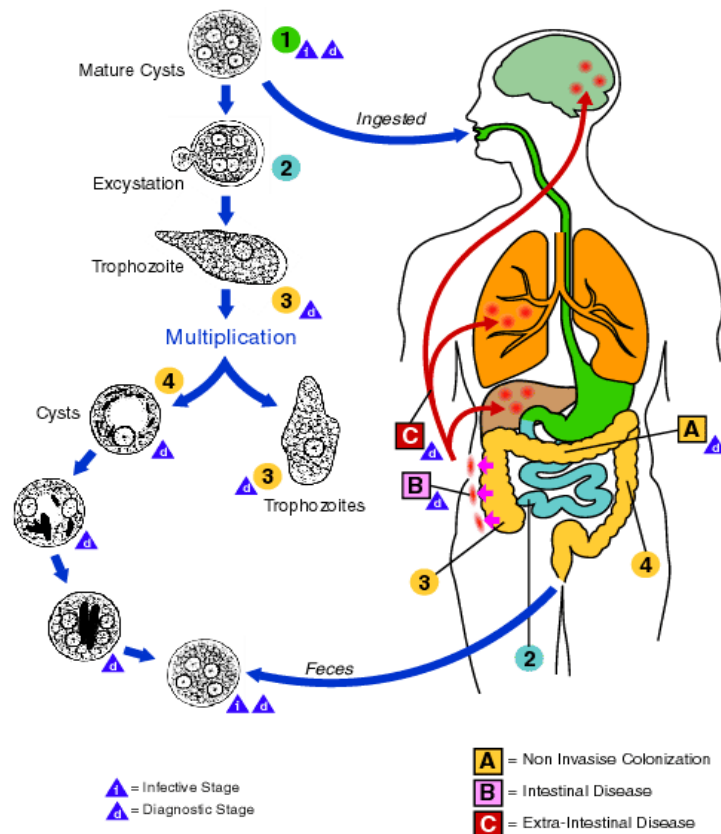


2. Cyst stage:

- Cyst can formed only in the luman of host intestine .
- Spherical or round or oval shape .
- Contain 1-2-3 nucleus (**immature cyst**), four nucleus (**mature cyst**) .



Diagnosis sample : Stool examination to identify **trophozoite** or **cyst**



Life cycle of *Entamoeba histolytica*

الاسبوع الرابع والعشرون

2 -The class Flagellates :

Divided in to **3 groups** due to their habitate :

- 1- **Intestinal flagellates.** Ex : *Giardia lamblia*
- 2- **Genital tract flagellates.** Ex : *Trichomonas vaginalis*
- 3- **Blood and tissue flagellates :** *Leishmania tropic*
Leishmania donovani
Leishmania brazillensis

Intestinal flagellates

Example : *Giardia lamblia*

Disease : Giardiasis

Habitate : Upper part of small intestine.

Host : Final host (human) , Intermediat host : No .

Infect stage : (Mature cyst with **4** nucleic)

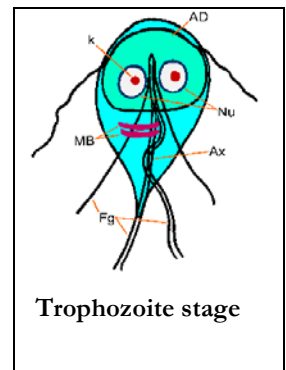
Diagnostic stage : Trophozoite and Cyst .

Mode of infection : Oral-route . (by ingestion mature Cyst with contaminated food)

Morphology : Have 2 stages:

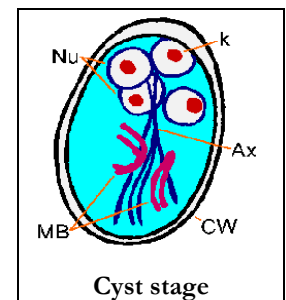
1. Trophozoite stage :

- Pear shape. – Size-long about (15M with 12 M)
- Bilaterally symmetrical .
- Two large sucking disc anteriorly .
- Two Axostyle .
- Two nucleic with large central Karyosome .
- 4 pairs of flagella .

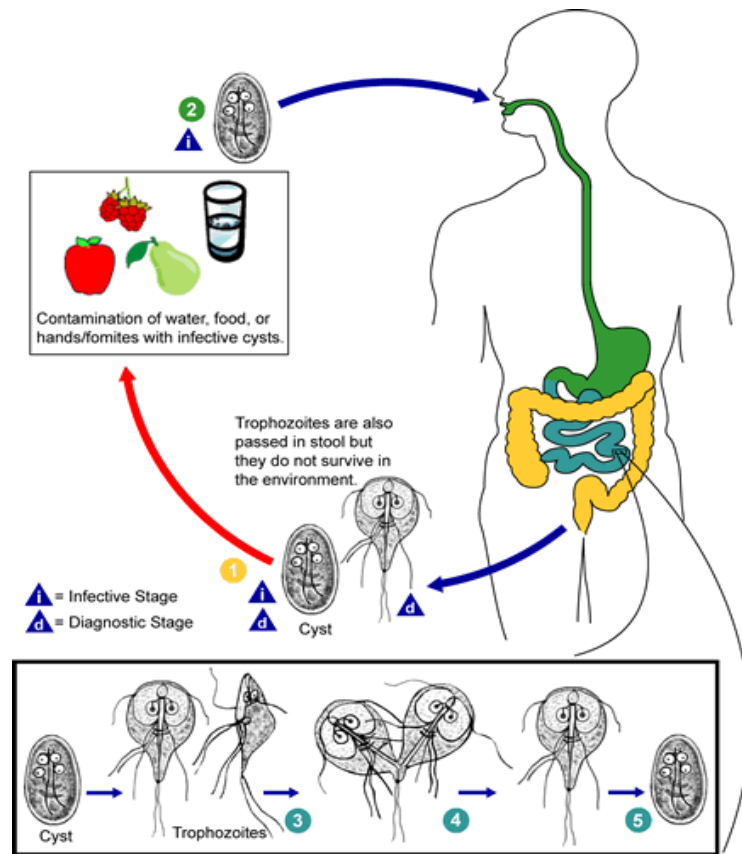


2. Cyst stage:

- Oval shape .
- Well define double cyst wall.
- 2 or 4 nucleic .
- Found in diarrheic stool and immature cyst found in normal stool in a large number .



Diagnosis : Stool → direct smear → iodine and Microscopic examination reveal trophozoite and cyst .



Life cycle of *Giardia lamblia*

Blood and tissue flagellates

(Haemoflagellates)

Phylum : Protozoa

Class : Flagellates include 2 genus :

Genus Leishmania

Genus Leishman include 3 speices infected human . *Leishmania tropica*

Leishmania donovani

Leishmania brazillensis

Example : *Leishmania tropica*

Disease : Cutaneous Leishmaniasis, troika sore, Baghdad boil . It cause 2 types of Lesion :-

- 1- *Leishmania tropica* major (Wet-type lesion) .
- 2- *Leishmania tropic* major (Dry -type lesion) .

Example : *Leishmania donovani*

Disease : Viscular Leishmaniasis or Kala – azar .

Habitat : Tissue of Reticulo – endothelial , system (Liver, spleen, lymphnodes, bone marrow

Example : *Leishmania brazillensis*

Disease : Muco cutaneous Leishmaniasis .

Habitat : Muco cutaneous membrane of (nose, Larynx, ear)

Host : Intermediate host : Female of **sand fly** . Final host : **Human** .

Infective stage : Promastigote stage .

Mode of infection : Through the skin by biting of infected insect vector (**sand fly**) .

Sample for diagnosis : Blood or tissue (skin according habitate).

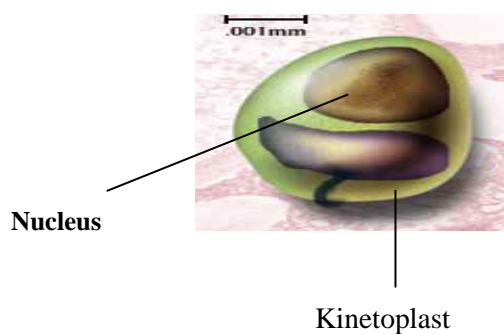
Morphology : Leishmania parasite found in 2 forms .

1- Amastigot stage : or (Leishmania form)

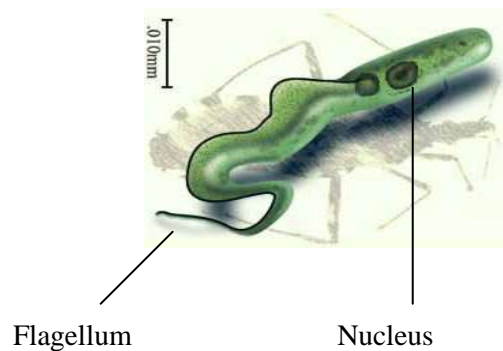
- This stage found in human only .
- Oval shape .
- One nucleus oval or round lies in the central .

2- Promastigote stage :

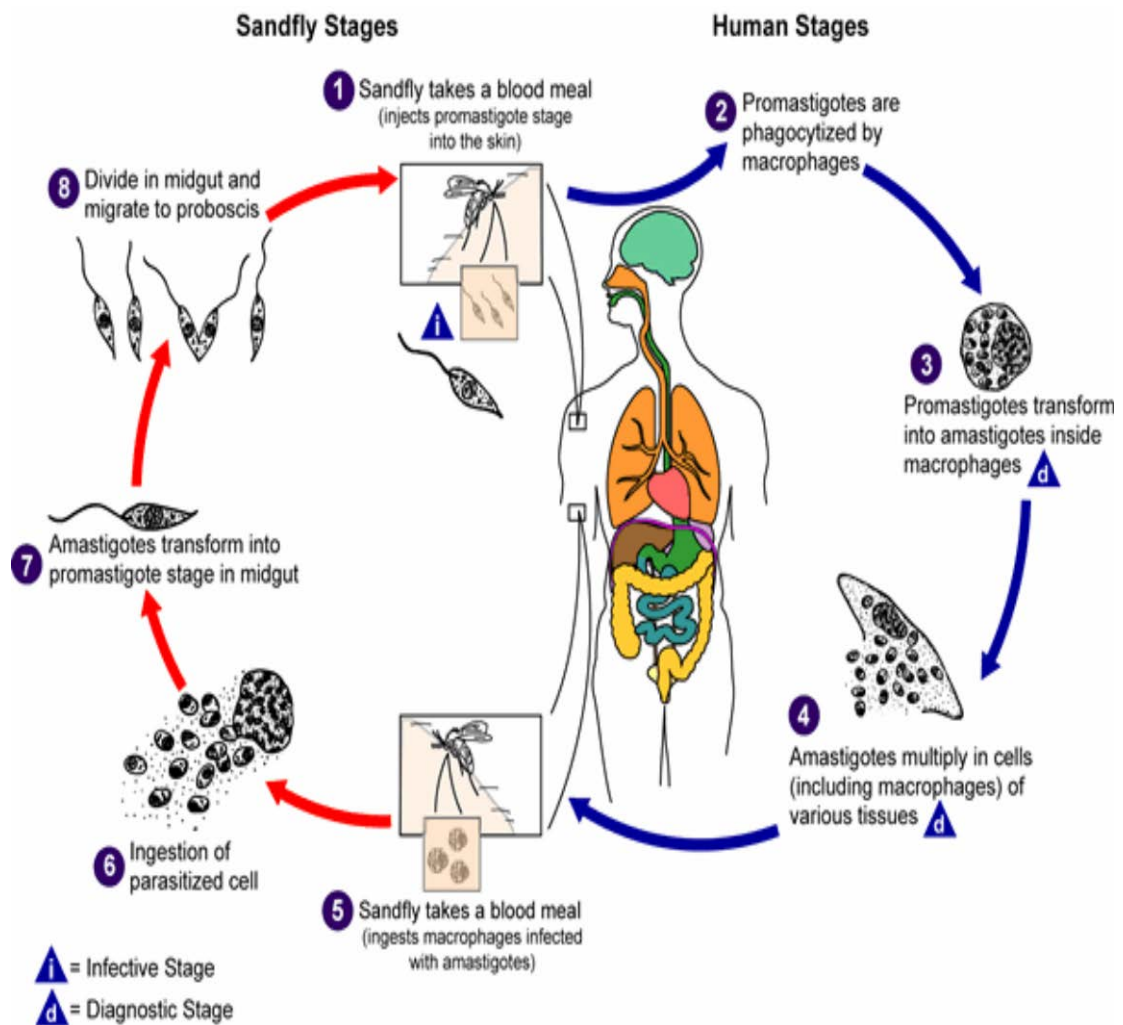
- Elongated shape or spindle .
- Found only in insect ,
- Nucleus in the middle (large).
- Have one free flagellum .



Amastigot stage



Promastigote stage



Life cycle of *Leishmania*

The class ciliate

Class ciliates .

Genus : Balantidium coli

Ciliates : The body of this protozoa cover with short hairs like processes known **cilia** .

Disease : Balantidiasis dysentery or Balantidiasis .

Habitat : Large intestine of man .

Host : Human

The infective stage : Cyst

Diagnostic stage : Cyst

Mode of infection : Oral route by ingestion mature cyst contaminated foods or drinks .

Morphology : Have 2 stages : 1-Trophozoite 2-Cystic stage . Both stages (Trophozoite and Cystic stage) have macronucleus (reniform is shape) kidney shape .

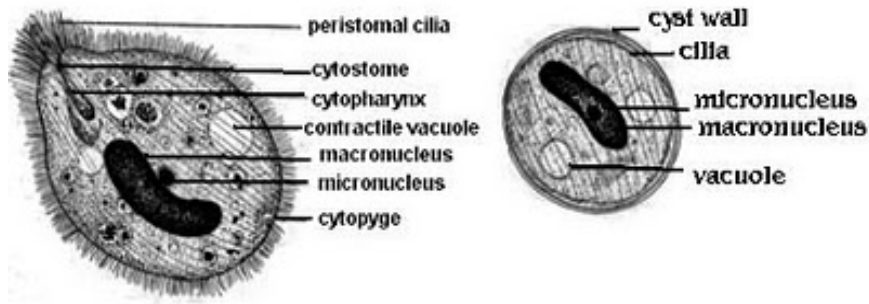
Trophozoite stage :

- Large oval shape .
- The cell coverd with cilia (Locomotive organs).
- The cell has two nuclei . **Macronucleus** and **Micronucleus** .

Cyst stage :

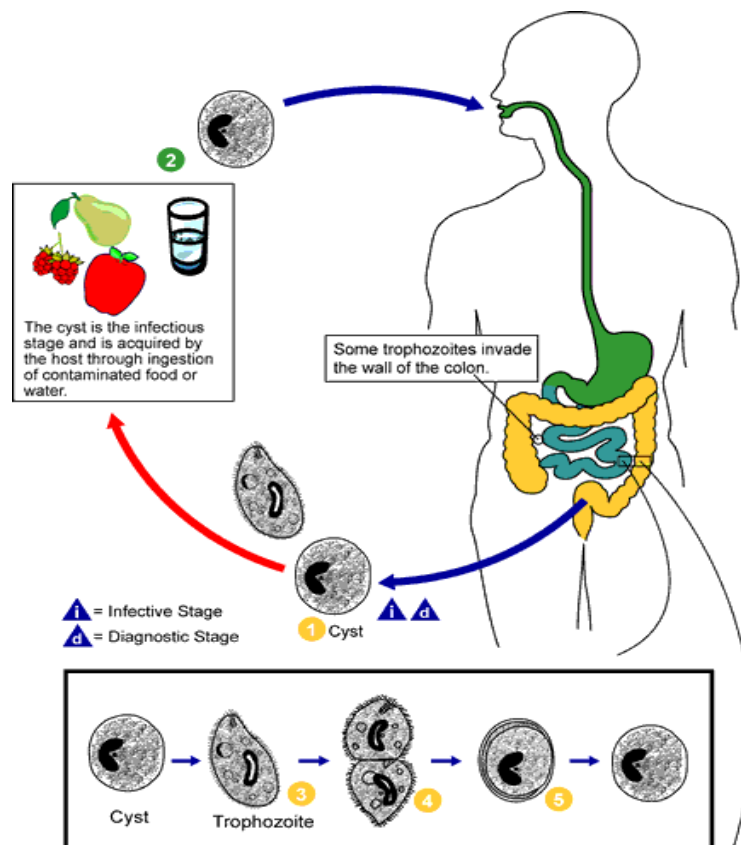
- Ellipsoidal shape.
- No ciliated and.
- Contain 2 nuclei spherical or ovoid in shape.

Diagnosis :- General stool Examination (G-S-E) infective cyst or non infective trophozoite . in the acute dysentery actively motile trophozoite are seen .



Trophozoite stage

Cyst stage



Life cycle of *Balantidium coli*

The class Sporozoa

Include 4 types :

Plasmodium vivax : cause Benign tertian malaria

Plasmodium ovale : cause tertian malaria

Plasmodium malaria : cause quarter malaria

Plasmodium falciparum : cause Malignant tertian malaria

Example : *Plasmodium vivax*

Disease : All species cause malaria .

Host : There are 2 host :

1. Intermediate host vertebrate host "**human**" in blood intra **RBC** cell (**Asexual phase**)
2. Final host: invertebrate host (insect) called (Female of Anopheles mosquito) as a vector. (**sexual phase**).

Vector : female of Anopheles insect (Mosquito) .

Infective stage : Sporozoite (salivary gland of Anopheles)

Mode of infection : By biting of Mosquito.

Habitat : In circulatory system of vertebrates .

Clinical aspects : (**fever, coldness, sweating**) that symptom occur during the sudden liberation of merozoites into blood stream . and bloody urine .

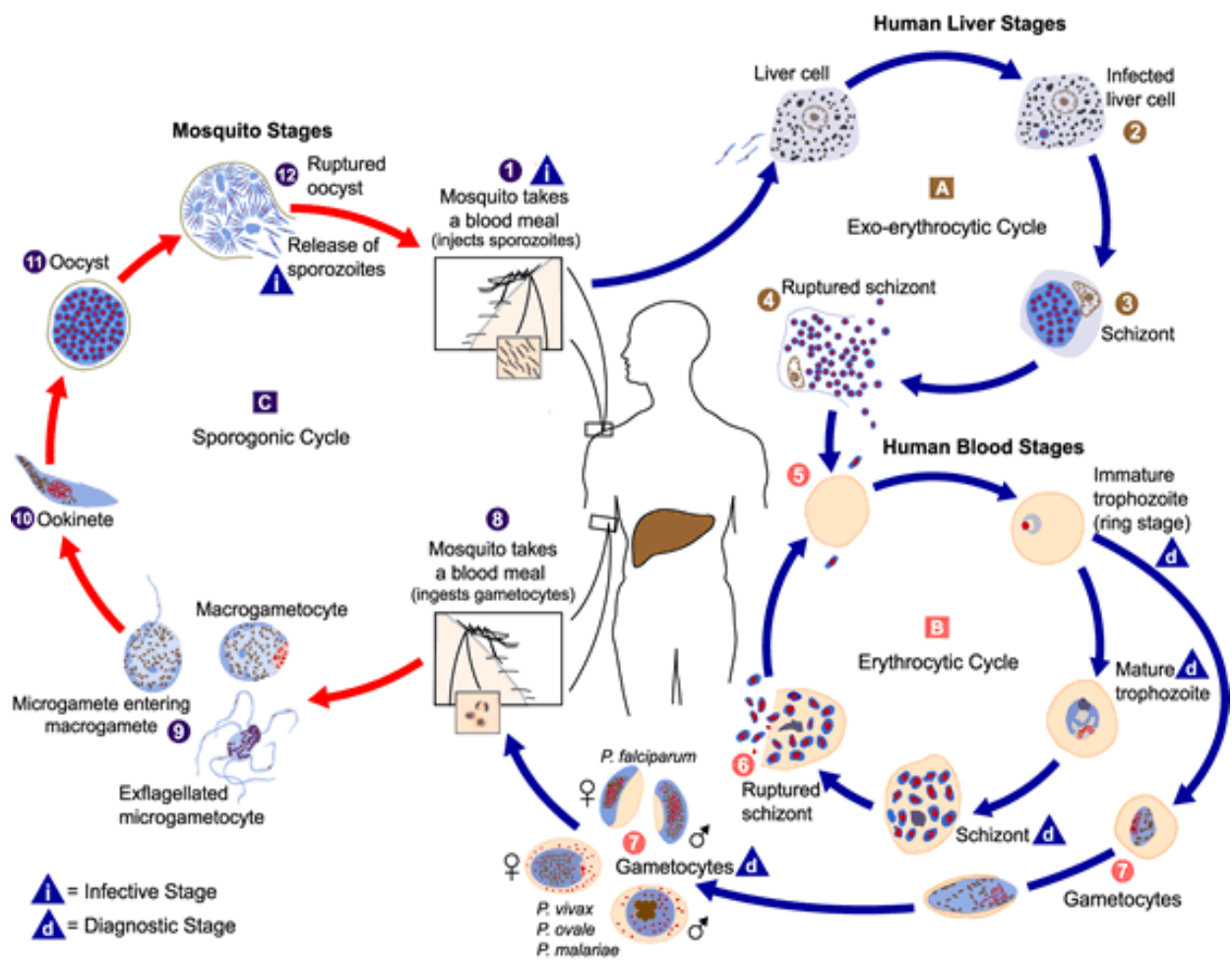
Laboratory diagnosis .

1. Microscopic examination of blood film **thick** and **thin** film .

thick film —————→ in case light infection

thin film —————→ in case species diagnose and maintain shape of **R.B.C** but in thick film **R.B.C** Lysed .

2. Immunological test .



Life cycle of *Plasmodium vivax*

Medical Helminthology

Platyhelminthes

Nemathelminthes

Acanthocephal

Platyhelminthes :

Class: Trematoda

General character :

1. This group of parasites is also known as **flukes** .
2. The body flattened (Leaf like) except of schistosomes which are elongated.
3. All are **monoecious**, except of schistosome (**Diecious**).
4. The eggs of trematoda are **operculateds** except of schistosome, have no **operculum** but have **spine** .

Phylum : Platyhelminthes

Class: Trematoda

Genus : Schistosoma

Species :

- *Schistosoma Haematobium*
- *Schistosoma mansoni*
- *Schistosoma Japonicum*

All trematodes pass through a phase of asexual development in the snail host

Bulinus truncates.

Disease : Urinary bilharziasis . *S. haematobium.*

Habitat : Depend on the type.

1. Adults :- Int the portal vein specially the vesical plexus of man .

2. Egg :- passes out in urine and very rarely in feces .

3. Larval stage :- in the tissues of snail *Bulinus* spp.

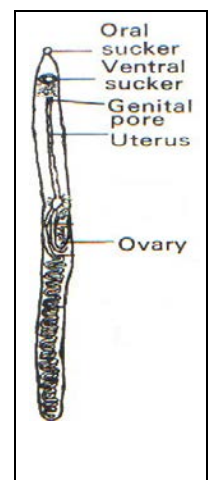
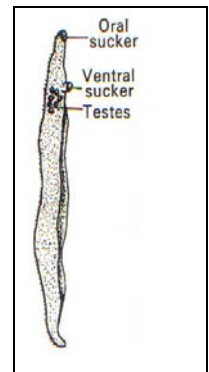
Morphology : Have two form Male and female .

1- Male :

- Have small oral sucker and larger ventral sucker .
- Have a gynaecephoric canal ,
- Cuticle on the dorsal surface.

2- Female :

- Body is cylindrical (thread like) .
- Cuticle is smooth (without tubercles).
- Ovary is small elongated .



There are three types of schistosome eggs :

1- *S. Mansoni* : Lateral spine.

2- *S. haematobium* : Terminal spine.

3- *S. japonicum* : Rudimentary spine .

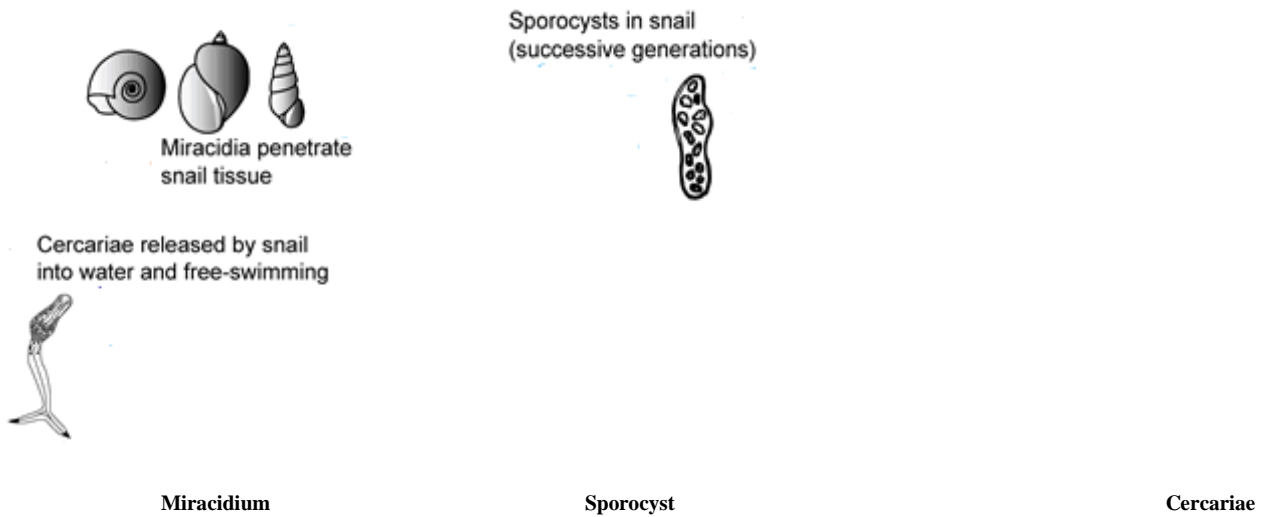
The larval stage of *Schistosoma* SPP.



1. Miracidium : is the Larval stage surrounded by cilia , that infected snail .

2. Sporocyst : 2nd Larval stage grow in the snail .

3. Sporocyst : Redia , Daughterredia , cercaria.

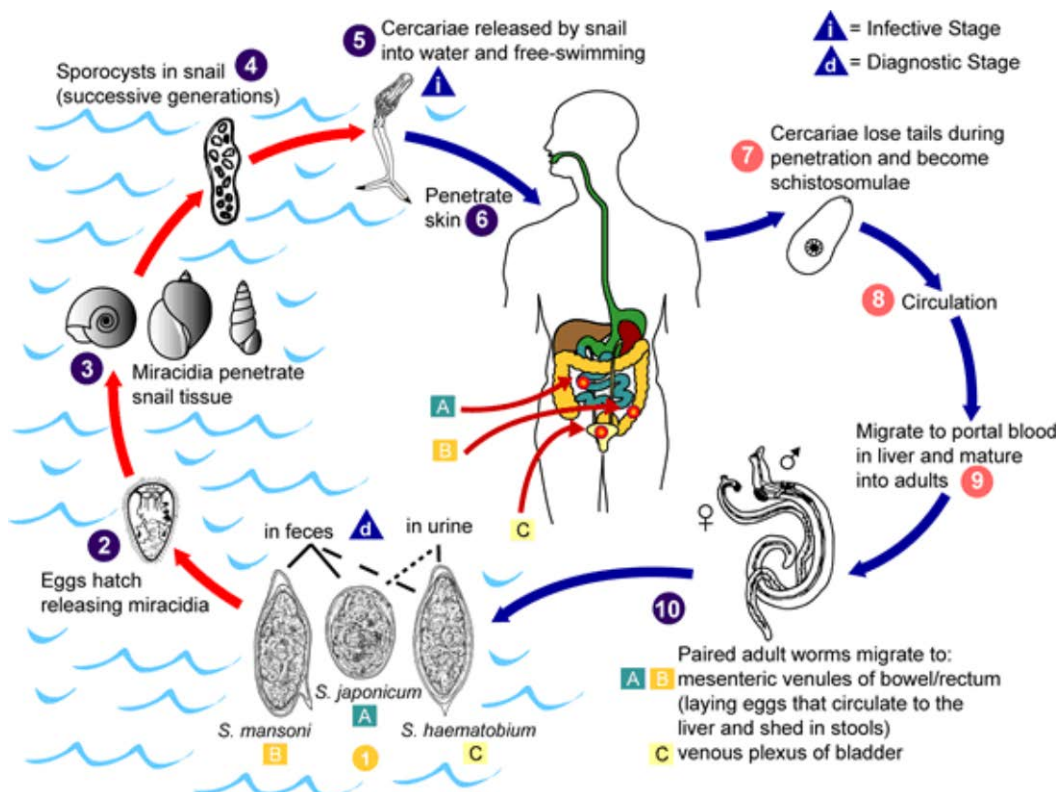


Host: Final: **human**. Intermediate host :- *Snail bulinus truncatus*

Infective stage : Cercaria with forked tail .

Diagnostic stage : Eggs with terminal spine in urine .

Mode of infection : By penetration of cercaria directly through the skin.



life cycle of schistosoma spp

Nemathelminthes :

Nematoda :

General characteristics :

1. Cylindrical worm, unsegmented, covered with thick layer of **cuticle**.
2. Has cutting plates, and teeth, mouth with buccal cavity.
3. Separated sexes. ().
4. No sucker and no hooks.
5. Has intestinal tract.
6. Has body cavity.
7. produce () a large number of ova.
8. Habitat in intestine, blood, tissues.

Class: Nematoda

Example : *Enterobius vermicularis*

Common name : pin worm

Disease : Enterobiasis or Oxyuriasis or pin worm infection.

Habitat : Large intestine in man.

Geographical distribution :

Host : a:- Final host :- **Man** b:- Intermediate host : **No**

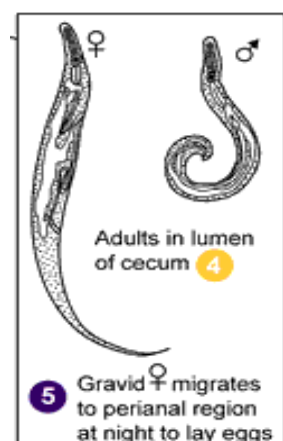
Source of infection :

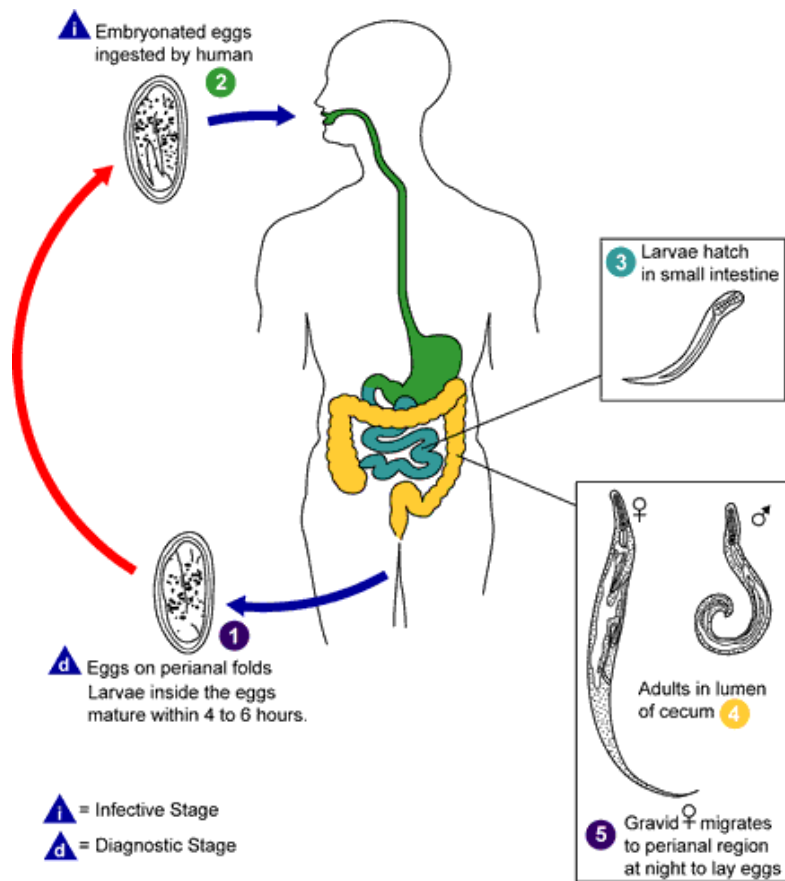
Infective stage : Embryonated egg.

Diagnostic stage : Egg and adult worm.

Mode of infection : Oral – route by ingestion of eggs.

Diagnosis sample : Stool.





life cycle of *Enterobius vermicularis*

Nemathelminthes :

Class: Nematoda

Genus :

Example : *Ascaris lumbricoides*

Common name : Giant round worm.

Common name : Giant round worm .

Disease : Ascariasis

Habitat : Small intestine of man and pigs .

Host : A: Final host : Man B: Intermediat host : No

Infective stage : Embryonated egg . (which contain mature larvae)

Diagnostic stage : Unembryonated egg .

Mode of infection : Oral-rout by ingestion of embryonated egg with food or drink .

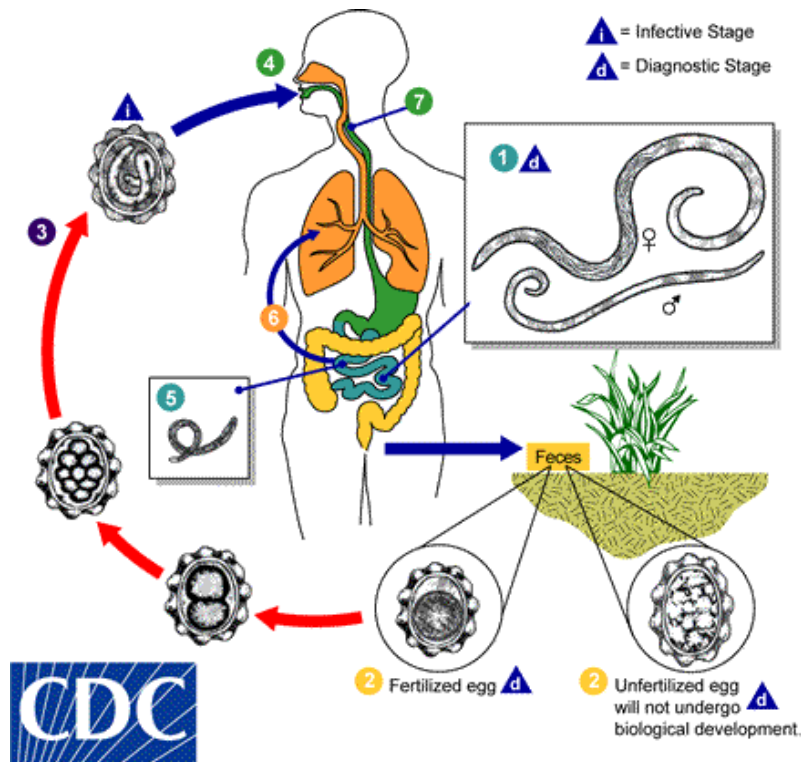
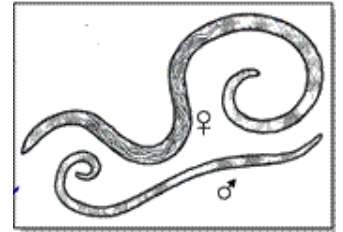
Morphology : 1. It is the largest intestinal nematode in man .

2. Body of adult is cylindrical with tapering ends .

3. Mouth is surrounded by 3 toothed lips .

Male : is smaller than female. **Egg :** Round or oval in shape .

Diagnosis sample : Stool .



life cycle of *Ascaris lumbricoides*

Nemathelminthes :

Class: Cestoda.

General characters .

1. The body of the worm segmented (proglottids)
2. The Length of the worm variable (few mm- many meter).

Adult worm consist of : **a.** scolex **b.** neck **c.** strobila (many of proglottid)

3. Scolex supplied with suckers .

4. Hermaphrodite (O + 7) in the same proglottids .

5. Development and complete reproductive system .

6. Segments or proglottids divided into .

A. Immature segment .Small and reproductive organ, located near the **Scolex**.

B. mature segment (proglottid) known **gravid segments** located in the end of worm body full with ova.

Class : Cestoda

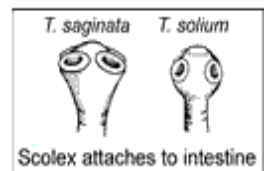
Genus : Taenia

Species : Taenia

Example : *Taenia saginata* , *Taenia solium*

Common name : Beef tape worm or Bovine tap worm .

Disease : Taeniasis or Beef tap worm infection .



Morphology :

1. **Scolex** : Round 12mm in diameter, has 4 suckers (cuplike) no spine hook and rostellum.
2. Length 5-10meter (2000 proglottids)
3. **Eggs** : spherical, 33-43um in diameter transparent shell, radically striated Layer surrounded the embryo (Hexacanth embryo)
4. Lateral branch of uterus /15-30 branch

Habitat : 1. Adults inhabit small intestine of man only .

2. Egg passes in human feces.

3. Larvae (Cysticercus) in the muscles of cattle.

Final host .Human (adult worm) in intestine .

Intermediate host : found Larval stage cysticercus bovis in the muscle of beef

Source of infection :

Infective stage of human : from eating meat contain Cysticercus bovis

Infective stage of animals: from eating eggs and gravid proglottid that found in stool

Diagnostic stage :

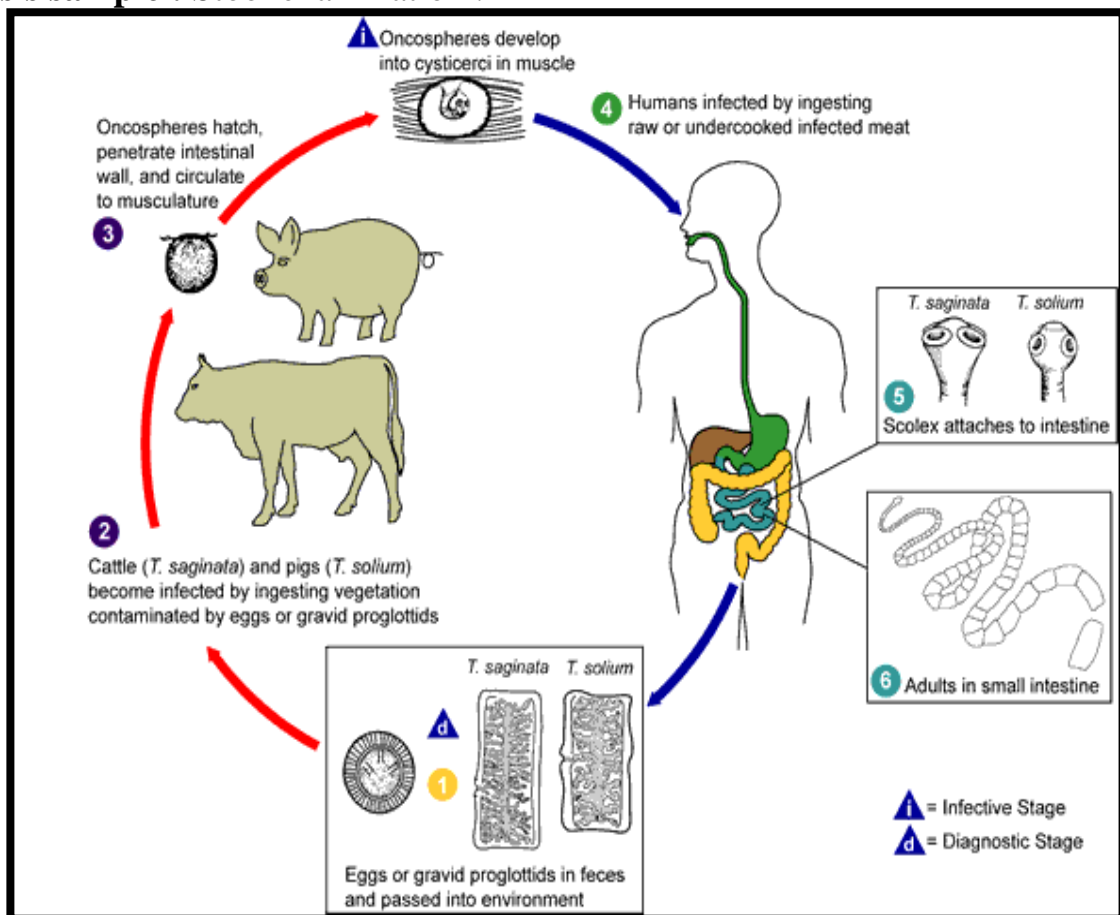
Mode of infection :

Diagnosis sample :

Morphology:

- Scolex :** 1mm in diameter 4suckers.
- Rows of spine hook with Rostellum.
- Eggs :** resemble that in *T. saginata* .
- Lateral branch of uterus, 5-15 branch.

Diagnosis sample : Stool examination :



Life cycle of *Taenia* spp.

The class Ciliate

Class ciliates .

Genus : *Balantidium coli*

Ciliates : The body of this protozoa cover with short hairs like processes known **cilia** .

Disease : Balantidiasis dysentery or Balantidiasis .

Habitat : Large intestine of man .

Host : Human

The infective stage : Cyst .

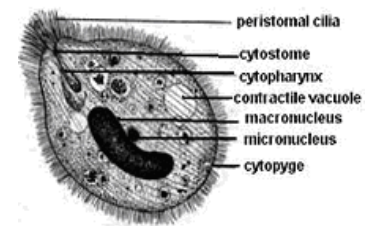
Diagnostic stage : Cyst .

Mode of infection : Oral route by ingestion mature cyst contaminated foods or drinks .

Morphology : Have 2 stages : 1-Trophozoite 2- Cystic stage . Both stages (Trophozoite and Cystic stage) have macronucleus (reniform is shape) kidney shape .

Trophozoite stage :

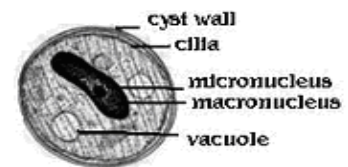
- Large oval shape .
- The cell coverd with cilia (Locomotive organs).
- The cell has two nuclei . **Macronucleus** and **Micronucleus** .



Trophozoite stage

Cyst stage :

- Ellipsoidal shape.
- No ciliated and.
- Contain 2 nuclei spherical or ovoid in shape.

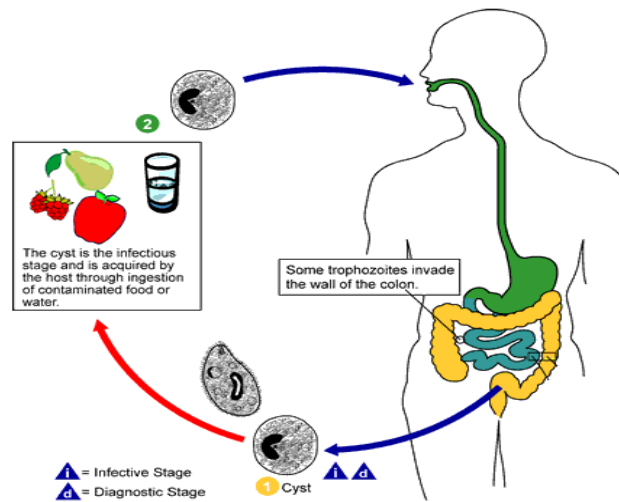


Cyst stage

Diagnosis :-

General stool Examination (G.S.E) :

1. In the acute dysentery, actively motile **trophozoite** are seen .
2. In norml dysentery,non motile **cyst** are seen .



life cycle of *Balantidium coli*

The class Sporozoa

Include 4 types :

Plasmodium vivax : Cause Benign tertian malaria

Plasmodium ovale : Cause tertian malaria

Plasmodium malariae : Cause quarter malaria

Plasmodium falciparum : Cause Malignant tertian malaria

Example : *Plasmodium vivax*

Disease : Cause Benign tertian malaria .

Habitat : In **circulatory system** of vertebrates .

Host : There are 2 host :

1. Intermediate host: vertebrate host " **human**" in blood intra **RBC** cell , **Asexual** phase.

2. Final host: invertebrate host (insect) called (Female of *Anopheles* mosquito), **Sexual** phase.

Vector : female of *Anopheles* insect (**Mosquito**) .

Infective stage : Sporozoite (Salivary gland of *Anopheles*) .

Mode of infection : By biting of Mosquito .

Clinical aspects : (**Fever, Coldness, Sweating**) that symptom occur during the sudden liberation of merozoites into blood stream .

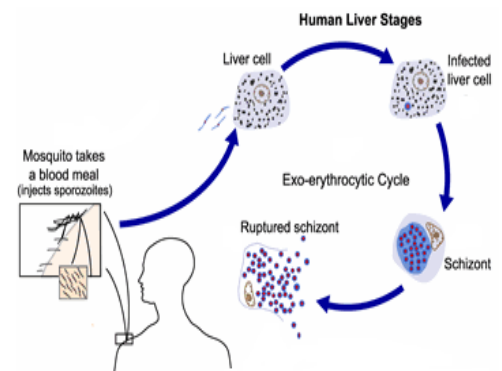
Laboratory diagnosis :

Microscopic examination of blood film **thick** and **thin** film . **To identify :**
Ring shape, Amoeboid shape, Immature Shizont shape, Mature Shizont, Gametocyte shape.

Life cycle of *Plasmodium SPP* : There are **3** stages .

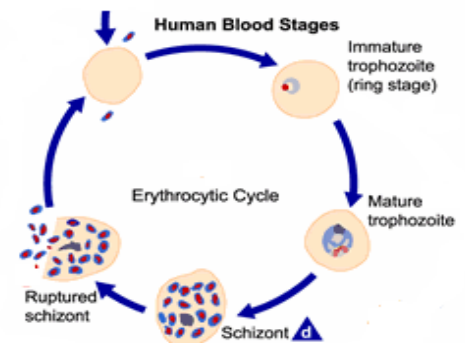
1. Human liver stages :

- Parasite enter the liver cells of the human .
- Reproduce in to cells called **Shizont** .
- Ruptured shizont .



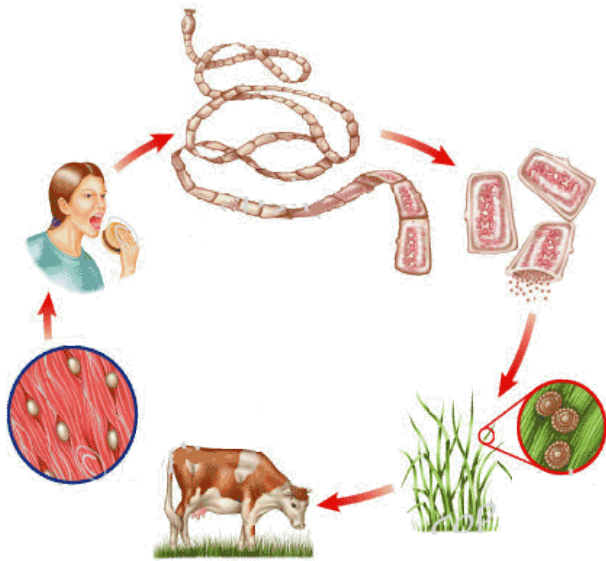
2. Human blood stages :

- The parasite (**Shizont**) enter to the (**Erthrocylic cycle**) and to the (**RBC**).
- The parasite (**Shizon**) attact the other (**RBC**).



3. Mosquito stageese :

- Mosquito takes meal contain (**gametocytes**).
- Relase the Macrogamets and Microgamets in the intestine of insect .
- Microgamets enter Macrogamets and become **Ookinete** and **Oocyte** .
- Relase the Sporozoites in the **Salivary gland** of insect.



Nemathelminthes :

Class: Nematoda

Example : *Ascaris lumbricoides*

Common name : Giant round worm.

Common name : Giant round worm .

Disease : Ascariasis

Habitat : Small intestine of man and pigs .

Host : A: Final host : **Man** B: Intermediate host : **No**

Infective stage : Embryonated egg . (which contain mature larvae)

Diagnostic stage : Unembryonated egg .

Mode of infection : Oral-rout by ingestion of embryonated egg with food or drink .

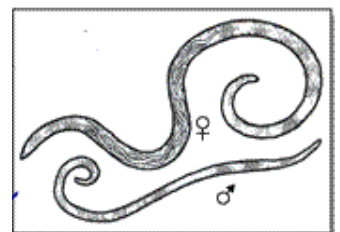
Morphology :1. It is the largest intestinal nematode in man .

2. Body of adult is cylindrical with tapering ends .

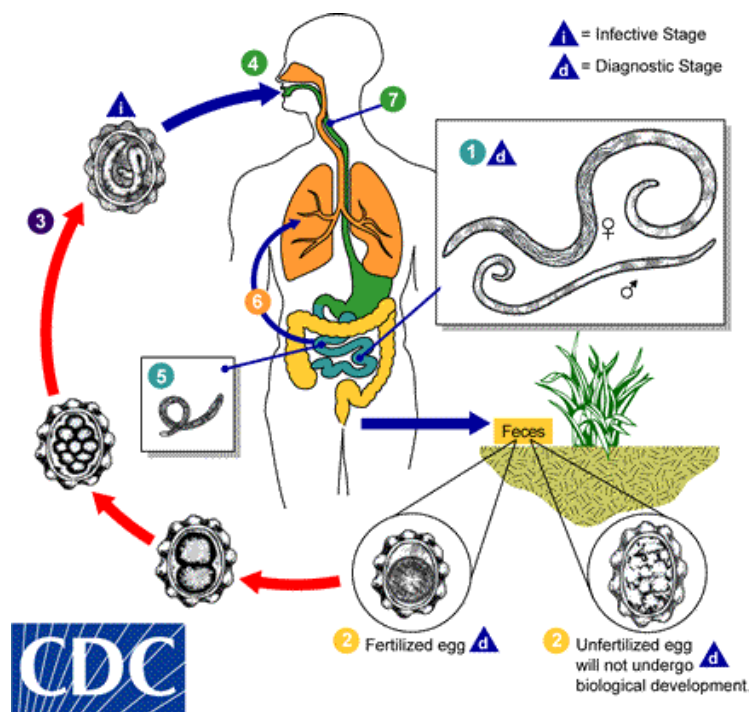
3. Mouth is surrounded by 3 toothed lips .

Male : is smaller than female. **Egg :** Round or oval in shape .

Diagnosis sample : Stool .



Male and Female of *Ascaris lumbricoides*



Life cycle of *Ascaris lumbricoides*

الاسبوع الثلاثين

Nemathelminthes :

Class: Cestoda.

General characters .

3. The body of the worm segmented (proglottids)
2. Adult worm consist of : **a.** scolex **b.** neck **c.** strobila (many of proglottid)
3. Scolex supplied with suckers .
4. Hermaphrodite (O + 7) in the same proglottids .
5. Development and complete reproductive system .
6. Segments or proglottids divided into : **A.** Immature segment, **B.** mature segment

Class : Cestoda

Species : Taenia

Example : Genus : *Taenia saginata* , *Taenia solium*

Common name : Beef tape worm or Bovine tap worm .

Disease : Taeniasis or Beef tap worm infection .

Morphology :

1.**Scolex**: Round or Pyriform shape, has **4** suckers (cuplike) no spine hook and rostellum

2.**Strobila**: Is creamy-white–yellowish in colour contain 1000-2000 segments.

3.**Immature segments** : are small and wider than length,

4.**Mature segments**: are nearly square and each one contain complete well developed set of both male and female reproductive organs.

5.**Eggs** : Spherical, brownish colour, transparent shell, radially striated Layer surrounding the embryo (**Hexacanth embryo**) Lateral branch of uterus /15-30 branch.

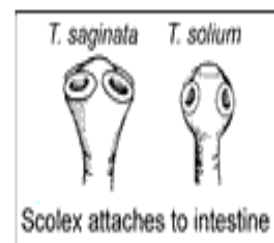
Habitat : 1. Adults inhabit small intestine of man only .

2. Egg passes in human faeces.

3. Larvae (**Cysticercus**) in the muscles of cattle.

Final host . Human (adult worm) in intestine .

Intermediate host : found Larval stage cysticercus bovis in the muscle of beef



Infective stage of human : form eating meat contain Cysticercus bovis or from eating eggs or gravid proglottid that found in the stool .

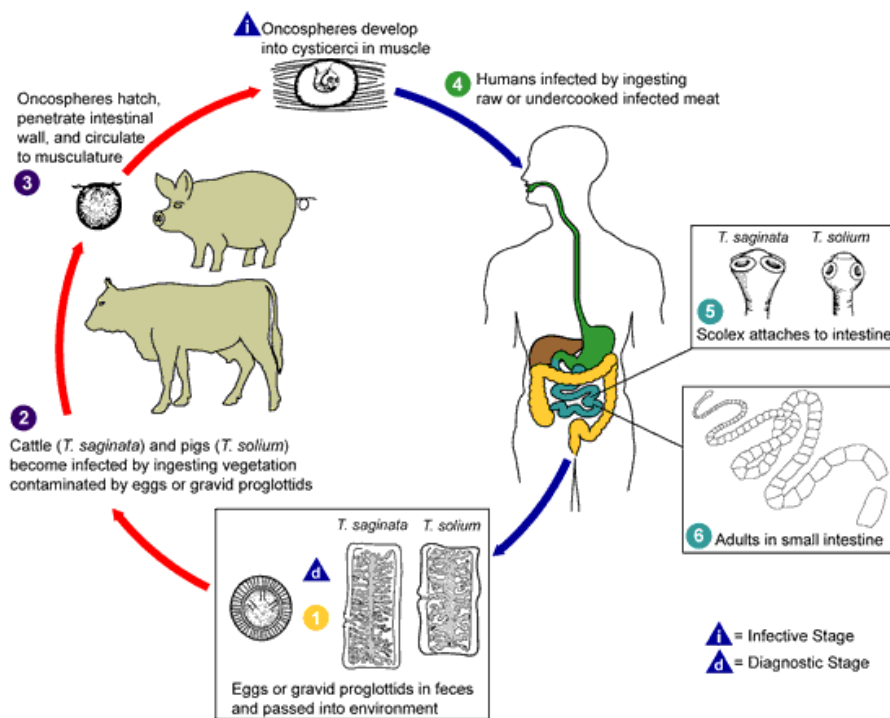
Diagnostic stage :

Diagnosis sample :

Morphology :

- e. Scolex : 1mm in diameter 4suckers.
- f. Rows of spine hook with Rostellum.
- g. Eggs : resemble that in *T. saginata* .
- h. Lateral branch of uterus, 5-15 branch.

Diagnosis sample : Stool examination



Life cycle of *Taenia* spp.

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