MICROBIOLOGY

BY MR GITONGA

MICROBIOLOGY

- Is the study of small living organism.
- Micro means very small and can be viewed by use of microscope.
- Bio means living organism.
- Ology mean study of.

HISTORY OF MICROBIOLOGY

- Long ago it was known that some disease could be transmitted from one person to another e.g. leprosy, plague, small pox which was eradicated in 1979 .
- Microbiology developed into science.
- Inquisitive question raised thus answers were sought about every day event e.g. why does milk ferment? How people who are recovering from cow pox do not get small pox? What were the causes of anthrax? where does microorganisms that contaminate food come from?

ROBERT HOOK

- Lived from 1635-1703.
- Was the first to describe simple moulds growing on leather.
- He suggested that the moulds were seeds similar to those found on top of mushroom.

ANTONY VAN LECUWENHOCK

- Was known as microbic hunter or father of microbiology
- He lived in Holland as a business manager of a shop
- He invented lenses and started looking at things as glass magnified them.
- In 1667 he described bacteria using a simple primitive microscope. This lens could magnify 300 times normal size, the size of a pin head.
- he observed materials placed on the pin head, he discovered the microscope hence father of microbiology.

CONT……

- He wrote letters to the society of Lagga which convinced scientist of the 18th century about the existence of microorganism.
- Described small animals as animalcules. He did not speculate or associate there origin as causing disease.
- The causes of disease in relation with animalcules was started in the 19th century.
- He was the first person to describe three shapes of bacteria:
  - rod shapes- bacilli
  - Spherical shaped- cocci
  - Spiral shaped- cock screw.
- He also discovered Protozoa, sperms, blood and blood cells.

LOUIS PASTEUR(1822-1895)

- He was educated in chemistry.
- In 19^{th} he studied microbiology in relation to animalcules .
- Many other sciencetist experimented about spontaneous creatures in infected wounds, fermenting grain, decaying meat they wondered how decaying occurred.
- They believed that life could develop spontaneously from decomposing non living materials.
- This was the concept of abiogenesis or spontaneous generation.

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- Louis disapproved this and came up with the theory of biogenesis which explain that there must be some air for life to exist.
- He investigated spoiling of beer and wine which is referred to as germ theory of fermentation.
- He concluded that sugar of ferment served as the food of micro-organism
- He said that each ferment is caused by specific organism that develop and grows only when the specific requirement of its well being are met.

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- Sugar was converted by this organism to alcohol.
- Yeast naturally occur on skin of grapes fruits and grains.
- Some other contaminants bacteria may change alcohol acetic acid or vinegar which ruins the taste of wine.
- To eliminate these bacteria from wine and beer pasture heated it at temperature of 120c-140c and the process is known as pasteurization.

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- For milk he heated at a temperature of 68c for 30mins or at a temperature of 72c for a period of 15mins
- He extended this theory from animal to human and stated that a specific disease is caused by a specific type of micro-organism.
- He invented a method to culture organism where they don seem to be.
- He invented methods on how to weaken or attenuate micro-organism by vaccination hence became the father of immunology.
- He discovered rabies vaccine in 1885.

JOHN TYNDAL-1820-1893

- He continued with the work of Pasteur
- He discovered that bacteria endospores are extremely heat resistance.
- When spores are exposed to heat briefly, they germinate into vegetative form of bacteria.
- Subsequently, boiling killed the newly formed vegetative form of bacteria. he advised an alternative sequent of heat that killed all bacteria present.
- He said that solutions to be treated are heated at 80c-100c for several minutes then incubated at 30c-37c for 24 hours on 3 days- tyndallisation.
- This allows the endospores to germinate when boiled for the first time then killed by next boiling.

ROBERT KOCH-1899-1910

- He was a physician and was a rural doctor whose interest in disease lead him to investigate anthrax.
- He showed that anthrax was caused by bacteria
- He grew the anthrax bacilli in pure culture and showed that it caused anthrax
- He had assistance known as Julius Petri and developed a petri dish that is used for microbial growth for solid medium
- He proved that a specific disease was caused by a specific micro-organism in a scientific procedure known as Koch's pastulates.

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- Microorganism must be present in all cases of disease and must not be present in a healthy animal.
- Microorganisms must be isolated from the diseased animals and grown in pure culture.
- Microorganism in this pure culture must cause the same disease when inoculated in healthy animal.
- The experimentally infected animals must contain microorganism which must be recovered again in pure culture.
- The pastulate become the scientific approach in demonstrating the infectious from a disease.

EXCEPTION OF KOCH'S

- Some people are healthy carriers of diseases but don't show symptoms.
- Some microorganism are difficult to be grown such as most viruses, leprosy and syphilis.
- Most of this microorganism may be grown in tissue culture such as egg embryo, scrotum of rabbits.
- In HIV human lymphocytes are required to act as culture for it to grow.
- Koch discovered vibro cholerae, tuba cal bacilli(cocci bacilli) that causes TB and anthrax bacilli.

EDWARD JENNER 1749-1823

- He was a rural doctor.
- He observed that dairy maids contracted cowpox which from infected cows which had lesions on their teats never contracted small pox even from infected family member.
- He become convinced that patient who were recovering from cow pox where were able to resist small pox.
- In 1796 he used cowpox virus to vaccine people suffering from small pox and discovered smallpox vaccine.

EMIL VEN BEHRIN

- Made toxoids of diphtheria and tetanus toxins thus started the use of anti-toxin.

SEMEMELIREIS

- Showed that puerperal sepsis was caused by infected agencies in the mother or hands of midwifes and doctors thus emphasized on washing hands before delivery thus become the founder of ***disinfection.***

JOSEPH LISTER

- Showed that there were fewer infection if instrument was boiled and disinfected.

UNITS OF MEASUREMENT

- The metric measurement are used to describe the size of microorganism.
- A metre is the basic units.
  - Metre is divided to 10 dm, 100 cm, 1000mm, one million micrometer, and one thousand million nanometer.

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- Bacteria- 2 micrometer .
- Virus- 0.05-0.15 nanometer.
- Protozoa- 2000 nanometer.
- Red blood cells- 10 nanometer.
- Size of microorganism is calculated by use of a microscope and a device called micrometer and the procedure is called calibration.

IDENTIFICATION

- Shape.
  - Is the first clue to identification e.g. bacteria may be spherical (cocci), Rod shaped (bacillus) and coma shaped.

CONT.....

- Size
  - Some cannot be viewed by bright field microscope but by dark field microscope e.g. tryponema pallidium.
- Cellular arrangement.
  - This method concentrate on how the cells are arranged e.g. some grow in pairs, clusters, chains and others have internal and external structures e.g. flagella and fimbria.
- Form and structure.
  - Most bacteria divide by binary fusion (mitosis) and is a process of division which results in to two equal daughter cells.
  - A few bacteria cells reproduce by budding to [produce daughter cells of equal size.

CONT.....

- Motility:
  - Bacteria cells with curved cells move with polar flagella which produce movement.
- Use of simple stains.
  - Bacteria structure are stained with chemical dyes to make them more visible in bright field microscope.
  - Procedure in which a single dye is used to stain a cell is called simple stain.
  - Many of the useful bacteria stains are positively charged chemicals e.g. crystal violet, basic fuschin and methyline blue.
  - The basic dye react with negative charged component to color the cells. Spores can be stained by malachite green only after significant heat is applied to penetrate the pores e.g. differential stain, acid fast acid stains and gram stain.

CONT.....

- **Gram stain.**
- Gram is the person who developed differential stain procedure in 1884 as a means of identifying cocci in lung tissue which was taken from patient who died of pneumonia.
- Gram stain is used today to determine gram negative and positive.
- The bacteria to be stained are spread on a microscopic slide and air dried.
- The slide is slightly heated over a low flame to fix the bacteria to the slide.
- A drop of crystoviloet is supplied to the smear for a short time before it washed of the slide with water.
- The crystal violet stain both cell type positive and negative blue.
- Grams iodine solution is then added to the slide which acct as a fixative by combining with crystal violet..

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- This becomes fixed in side gram positive cells.
- The film is washed with water again dried and treated with alcohol or acetone until no more of this dyes is able to come out in a process called discoloration
- During discolourization the blue crystal violet iodine complex is washed out of the gram negative cells. The slide is counter stained with safranin.
- The gram positive cell remain blue violet through out this procedure since they retain crystal violet stain.
- The gram negative cells initially stained blue but loose the crystal violet when washed with alcohol or acetone.
- The safranin counter stain or convert the colorless gram negative cells to a red color that makes them visible under the light microscope.
- Most bacterial species are either positive or negative.

ACID FAST STAIN

- It is a differential stain used to identify mycobacterium spices.
- Acid fast bacterial contain wax like material that bind a primary dye even when they are washed with acidified alcohol.
- In the ziehl Nelson acid fast stain the cell are treated with hot carblofulschin.
- Non acid fast bacteria are initially stained with red dye but are decolorized when they are washed with acidified alcohol.
- Methylene blue is used to counter stain the non acid bacteria. When an acid fast stain is done on a sample of human sputum, the microbacteria are red while the tissue cell and non acid fast bacteria are blue.

OTHER METHODS OF IDENTIFICATION

- Metabolic reaction.
  - Bacteria produce secretion which are specific that increase the virulence of the microorganism e.g. some produce pus, enzyme(staphylococci) Toxin(streptococci), clostridium.

PHYSIOLOGY OF MICROORGANISM

- It is similar with organism cells.
- Majority of microbes are aerobes, this mean they grow best in an atmosphere that contain oxygen
- Anaerobe bacteria grow in the absence of oxygen.
- Obligate anaerobe die if the are exposed to oxygen.
- Facultative anaerobe can survive in an atmosphere having oxygen or no oxygen.
- All bacteria require temperature of 37 degrees centigrade but some can grow in dry condition e.g. rod shaped bacilli, other can only survive in moisture e.g. HIV/AIDS.

TERMINOLOGIES

- Pathogen- microbe that produce a disease state.
- Virulence- refer to the degree of pathogen city.
- Pathogenicity- disease producing ability.
- Endo spore- is a spore formed within a cell.
- Enteric – found in the intestines
- Exotoxic- protein poison found out side the producing cell.
- Reservoir- any site where the pathogen can multiply until it is transmitted to it host.
- Antibody- protein produce by the body in response to foreign substance (antigen) that will specifically react.
- Antigen- is a specific substance which under favorable condition can cause the body to produce antibodies.
- Cupsid- protein court or shell that either surround the viral nuclei acid or complexes with it to form a nucleo cupsid.

CONT.....

- Definitive host- one who carries the adult form of parasite or where the sexual cycle takes place e.g. man is a definitive host for round and tapeworms, mosquito is to plasmodium.
- Intermediate host-one who contains or harbors the larvae state of a section state of parasite e.g. in malaria is to man.
- Parasites- is a living organism(animal, bacteria, virus fungi etc) that receive nourishment from another organism (host).
- True parasitism- is the association of parasite and the host. The parasite receive shelter and nourishment from the host and in addition inflict disease and cause damage.

CONT……

- Replication- a process of multiplication of viruses where by they first control the host cell activities after which they start multiplying within the host.
- Host – is the organism that harbor or carries the parasites.
- Commensal (Nomo flora)- is an association of different organism in which one member of the association receives nourishment and shelter but the host is not destroyed by the parasite.
- Carrier- is an individual infected by a pathogen who does not show clinical sighs of infection.
- coliforms- is lactose fermenting gram negative rod shaped bacteria that inhibits the intestine.

MODES OF DISEASE TRANSMISSION

- There are five ways of transfer of pathogens from an infected person to a susceptible person.
  - Direct skin contact- common diseases like measles, chicken pox, colds and influenza, dermatitis, boils, streptococcal and staphylococcal
  - Mucus to mucus- can be transmitted kissing, sexual intercourse.
  - Air droplets or dust- in air droplet there is colds, measles, influenza, mumps, chicken pox. Pneumonia and TB.
  - Food , water and soil- it through indirect contamination of food, water by fecal material, dead or life animal e.g. cholera , typhoid, poliomyelitis, hepatitis, amoebiasis, staphylococcal food poisoning, giardiasis.
  - Blood contamination- blood can be contaminated by athropods, syringes, intravenous fluid in fusion e.g. AIDS, malaria, yellow fever, plague and sleeping sickness.

CLASSSIFICATION OF MICROBES

- Bacteria
- Virus.
- Fungi
- Protozoa
- Others are known as lower class of bacteria e.g. Spirochaetes, Rickettsia and Chlamydia.
- The lower forms of bacteria are bacteria but don't posses all the attributes of typical bacteria, they are very small and difficult to isolate.

BACTERIA

- Single cell organism.
- Don't require living cell for growth.
- Are free living organism that utilize the nutrients of the body as a food source.
- Bacteria's are gram positive or gram negative.
- Gram positive which have medical importance are streptococci , clostridium, mycobacterium, corynabacterium, actinomyces.

CONT.....

- Gram negative bacteria's are triponemas, borrelia recurentis, neisseria, brucelosis, bordetela pertusis, vibrio cholerae, haemophilas influenza, entero bacteria, salmonella typhi, shigella, proteus enterorobactor, klebsiella, yersnia pestis, pyerichia colic (rod shaped).

COCCI

- round/ spherical shaped bacteria
  - Staphylococci aureus which causes food poisoning and grow in clusters like grapes.
  - Staphylococci albus.
- Streptococci cling together forming long chains of streptococci viridan, pneumococci which grow in double pair or chains.
- Gonococci grows in pair thus pneumococci and gonococci are called diplococci.

BACILLI

- Are rod shaped, found in intestinal tract as normal flora but they become pathogenic when they enter other part of the body.
- The rod may be , short , thick, thin, pointed, or blunt e.g. mycobacterium leprae that cause leprosy and mycobacterium tuberculosis.

Vibrios

- Are coma shaped and rigid non moving bacteria e.g. vibriocholerae.
- **spirochaetes**
- They are spiral shaped slender and they don't stain easily.
- They must be viewed or visualized under dark microscope.

SPIRACHAETES

- Are spiral shaped.
- Are slender.
- They don't stain easily.
- Must be visualized through dark field illumination. Example is tryponema pallidum.

PATHOGENESIS OF BACTERIA

- They localize in specific organ often producing acute inflammatory reaction in response to toxins or enzymes released.

Rickettsia

- Is a lower form of bacteria and was named after DR. Rickettsia.
- It was small parasitic organism thought to be related to virus due to small size
- It divides intracellularly by binary fusion.
- It is an obligate intracellular parasite that grow in animals and parasite tissues.
- It transmit disease through bite or feaces of an infected insect vector e.g. fleas , lice, ticks.

SIGNS OF TYPHUS

- It is characterized by elevation of temperature.
- Skin rush caused by multiplication of rickettsia in the cell of small blood vessels which lead to damage of cells

Chlamydia

- is the same as rikettsia but they lack protein.
- Human are the major reservoir for Chlamydia trachomatis.
- Causes infection of the human eye, genitalia and urinary tracts.
- Easily transmitted during sexual contact.
- Disease caused by Chlamydia are:
  - Urethriritis, cystitis, prostitis, pelvic inflammatory disease, trichomoniasis, neonatal eye disease.

GRAM POSITIVE BACTERIA.

Streptococcus

- Exist as part of normal flora in human.
- They are found in skin, vagina, mouth, nasal cavity and pharynx.
- Streptococcus cause pyogenic disease(pus forming) ranging from boils to septicemia (blood infection).
- Pathogenic species of streptococcus are:
- streptococcus pyogenes which cause streptococcal pharygitis.

CONT.....

- localized dermatitis cause skin diseases.
- Beta haemolytic streptococcus group A Which cases tonsillitis and rheumatic fever , acute nephritis, wound infection.
- Streptococcus pneumonia causes bacterial pneumonia,tooth decay and meningitis.
- Opportunistic streptococcus- are potential pathogenic if removed from their normal flora e.g. streptococcus viridan, streptococcus faecalis a normal flora in mouth and skin and cause sub acute bacterial endocarditis.

- staphylococcus.- exist as normal flora as for streptococcus.

CONT.....

- pathogenic group are:
- Staphylococcus aureus which causes wound infection, boils of all kind, otitis media, pneumonia, eye infection and food poisoning.
- Bacillus
  - rod shaped and form endospore.
  - Are resistant to heat.
- Pathogenic group-
  - anthrax bacillus found in animal meat and animal product e.g. wool, hide and carcasses and cause anthrax disease which is a zoonotic infection.

CONT.....

- Clostridium
  - Are obligatory anaerobic.
  - Are spore forming.
  - Are rod shaped and produce powerful toxin.
- Pathogenic group.
  - clostridium botulinum which produce botulism and the` toxin produced harm the nervous system.
  - The toxin is produced by this bacterium in canned food, tinned fish and vegetables.

CONT.....

- Clostridium tetanae- produces tetanus toxins and causes tetanus.
- Clostridium welchii has five types. The one which causes clostridium welchii type two causes gangrene and it produces toxins and causes food poisoning. Others are clostridium odematiens, clostridium septicum.

Cont.....

- Mycobacteria-
  - it is acid fast.
  - Aerobic rod shaped
- pathogenic group
  - mycobacteria tubercle which are two types human type which cause pulmonary TB and is air borne. Bovine type found in cows and is taken through milk and causes miliary tuberculosis which affect the glands
- Mycobacterium leprae- causes leprosy and grows very slowly in cold part of the body and cannot be cultured on the face, finger, toes nose and testes.

CONT.....

- **Coryna bacteria-**
- rod shaped.
- mainly found on the skin and human respiratory tract.
- **Pathogenic group-**
  - coryna bacteria diphtheriae
    - which causes diphtheria.
  - Actinomyce .
    - which are aerobic and facultative anaerobic e.g. actinomyce israelii.
    - a normal inhabitant of human tonsils.
    - Causes disease after tooth extract. Cause abscess in human connective tissue e.g. actinomycosis.
  - Norcadia group-
    - it causes lung infection called norcadiosis.
    - Man inhales it in to the lung thus causing disease.
    - It causes chronic abscess under the skin

GRAM NEGATIVE BACTERIA.

- spirochaetes
  - They are motile by means of fragella.
- Pathogenic group.
- Tryponema
  - live in human and animal and are of two species tryponema pallidum which get through the body via mouth, mucus, anus and skin lesion. causes a disease called syphilis.
  - Tryponema pertenua spread by direct contact with skin lesion and causes a disease called yaws.
- Borrelia
  - they live in association of mammal insects birds. Transmission is by ticks or lice to human host and are two species
  - Borrelia recurrentis -cause louse borne relapsing fever in human.
  - Borrelia duttoni-cause tick borne borrelia disease.

CONT.....

- Leptospira-
  - they are found in swimming pools, streams and infected animals.
  - It is a zoonotic disease of domestic, wild animals and human.
  - Contracted through skin lesion, contaminated water or mucus membrane.
- Pathogenic group
- Leptospira icterohaemorrhagia which cause a disease called weils disease(sewer worker disease).
  - It is carried by rats.
  - It enters the body through damaged skin and mucus membrane.
  - Signs are elevated temperature, jaundice and bleeding.

NEISSERIA

- Non motile.
- aerobic diplococci,
- inhibit mucus membrane of animals.
- It is a normal flora of human genitourinary and conjunctiva.
- Pathogenic group.
- Neisseria gonorrhoeae(gonococcus).
  - The disease caused is gonorrhea, urethritis, pelvic inflammatory disease(PID), salphigitis(inflammation of fallopian tube) and ophthalmia.

CONT.....

- Neisseria meningitis(meningococcus).
  - Inhibits the nasapharynx of human. Disease caused is meningitis(cerebral spinal fever or meningococcal meningitis).
  - Occurs in epidemic.

BRUCELLA

- was discovered in 1889 by Bruce.
- Natural host is sheep and goat.
- Are obligate parasite that cause disease in sheep, goat and laboratory animal.
- Disease caused is brucellosis and is common in vetinary officers, meat packing and livestock workers as they come in to contact with infected animals.
- It is secreted In goat and cow milk and transmitted through drinking un boiled milk.

CONT.....

- **Pathogenic group-**
- Brucella melitensis and cause a disease called brucellas andorant fever around Mediterranean sea. it cause brucellosis in man through taking raw goat milk.
- Brucellar abortus which causes abortion in animals.
- Brucellar suis which causes death in pigs.

BORDETELLA

- It is a small.
- capsulated bacteria.
- it is an aerobe,
- non motile which produces toxins.
- **Pathogenic species**.
- Bordetella pertusis
  - Host is human.
  - Mode of transmission is air.
  - Organism adhere and multiply in epithelium of trachea and bronchioles.
  - The toxin is produce causing irritation.
  - The disease caused is pertussis(whooping cough).
  - It controlled by pentavalent vaccine.
  - Pertussis grows on the respiratory system.

HAEMOPHILUS

- Blood loving because it requires factor Y and X for growth.
- Aerobic.
- Non motile ,
- Non spore forming
- The species are obligate parasite of obligate animals.
- Pathogenic group-
- Haemophilus influenza,
  - are six type A to F.
  - Disease caused are meningitis in infants , lower respiratory tract, otitis media caused by type B, nasalpharyngitis caused by type B, conjunctivitis, sinusitis.
- Haemophiluss aegyptius.
- Causes conjunctivitis and highly communicable.
  - Haemophilus ducrey, cause chancroids or soft chancre which is sexually transmitted infection characterized by non syphilitic lesions and characterized by lesions in genital area, ulcer with marked tenderness and swelling.

PASTULLELLA.

- It is facultative anaerobic.
- rode shaped.
- non motile and small.
- true parasites of mammal and bird.
- Inhibit parasites e.g. ticks fleas etc.
- The flee bite an individual thus getting the disease.
- **Pathogenic group-**

CONT……

- Yersinia pestis
  - Non motile
  - Transmitted from one rodent to the other through bite by flees which have become infected by sucking blood of infected animals.
  - Organism grow in the intestinal tract of the flea and block the lumen.
  - It bites and regurgitate plague bacillus in the bite wound thus plague is transmitted from rodent to rodent and occasionally from rodent to human.
  - It is usually transmitted from human to human by fleas.
  - When individual is infected pneumonia develops, Droplets containing plague bacillus are coughed out which result in primary pneumonic plague which is fatal with out treatments which is then transmitted from person to person.

CONT.....

- Bubonic plague.
  - when plague bacillus enter the host through the mucus membrane or though the bite of a flee .
  - they travel through the lymphatic system and to the regional lymph nodes. This causes hemorrhagic inflammation and the nodes enlarge forming a bubol. later this bubols spread to axilla, groins ,spleen , liver lungs and CNS causing necrosis,
- Yersinia enterocolitica-
  - causes enteric disease and bacteremia.

ENTEROBACTERIA(COULIFORM BACILLI)

- Individual group includes
  - klebsiella,
  - Escherichia colli,
  - shigella,
  - vibrio,
  - Anterobactor
  - Enterobactor.
- Klebsiella
  - is facultative anaerobe,
  - has capsules,
  - no motile,
  - difficult to isolate.

CONT.....

- Pathogenic group
- Klebsiella pneumoniae
  - Causes pnemonia, sinusitis, otitis media , urinary tract infection.
- Escherichia coli.
  - Obtains nutrition from food ingested by the host.
  - Produces vitamin K to be absorbed by the host.
  - It used as indicator of human fecal contamination.
  - Disease caused are urinary track infection in women, travelers diarrhea and infantile diarrhea.

SALMONELLA

- Not motile.
- Intestinal pathogen.
- Produce endotoxin.
- They are responsible for enteric fever and gastro enteritis.
- Transmitted through oral fecal root(4 Fs)
- **Pathogenic group-**

CONT……

- Salmonella typhi.
  - Cause s typhoid fever,
  - Found in human who are ill its also found in patients recovering from the disease .
  - Produces toxins.
  - Transmission is through oral fecal route, contaminate food or fluids that goes through the intestine and eventually to the blood vessels and lymphatic systems.
  - septicemia result.
  - Sign and symptoms of first week are fever, headache , constipation.
  - Second week are rose skin sport eruption(skin rush), profuse diarrhea(pea soup diarrhea) that is greenish in colour.
- Salmonella Para typhii.
  - Causes enteric fever which is milder than the one caused by salmonella typhii.
- Other salmonella.
  - Are primarily animal pathogen which occasionally attack man and cause food poisoning e.g. salmonella typhinunium and salmonella enteridis.

SHIGELLA

- Are non motile rod shaped aerobic bacilli.
- Are obligate parasite and dysentery bacillus.
- Species are four- Shigella shiga, frexineri, sonnie and boydii.
- They can pass through the toilet paper and can survive on fingers for several hour.
- The disease caused by four above species is called bacillary dysentery.
- There is infection of small and large intestine and this cause abscess.
- The disease is characterized by blood, mucus and pus, nausea , vomiting, elevated temperature, convulsions and abdominal pain.
- The disease is referred to as shigellosis, is self limiting , of short duration and transmitted through oral fecal route.

OPPORTUNISTIC PATHOGENS

- Are inhabitants of human faeces, animal intestines, soil and water.
- They cause infection in human when immunity is low.
- Examples are
  - proteus which causes urinary tract infection,
  - vibrio which are coma shaped, bacillus, motile, flagellated. Transmission is through oral fecal root and live in aquatic environment.
- **Pathogenic types**.
- Vibrio cholerae-
- multiply in human intestine.
- produce an enterotoxin which act on the epithelium and provoke un sustained out poring watery diarrhea called rice water diarrhea .
- Causes cholera and common in Kenya.

TYPES OF CHOLERA

- Eltor cholera common in Kenya.
- Inaba cholera.
- Ogawa cholera.

COMPYLOBACTOR

- Found in intestines.
- Found in uncooked food, poultry and infected water.
- Diseases caused is gastroenteritis.
- Patient present with diarrhea and colic pain.

NORMAL FLORA (COMMENSALS)

- Normal flora of person include all microbes that normally are found on or within the human body.
- This microbes are provided with nutrient and shelter with no effect on the welfare of the host e.g.
  - in mouth there is cocci, bacilli protozoa and lacto bacillus.
  - In respiratory tract there s staphylococci, neisseria and coliny acteria.
  - In nose there is bacteriods.
  - On skin there is staphylococcus aureus, streptococci, E.coli, candida albicans.
  - In ear and eyes there is streptococcus, staphylococcus , neisseria and coliny bacteria.
  - In urinary genital area there streptococcus , virus yeast,diptheloids.
  - In vagina there is lacto bacillus, yeast, streptococcus, staphylococcus
  - In GIT-many normal flora are found in lower intestine.
  - In large intestine there is fungi, protozoa, clostridium.

BENEFICIAL ROLE OF NORMAL FLORA IN THE BODY

- couliform bacteria synthesizes vitamin k and also vitamin b12, peridoxin and dioxin.
- They prevent other microorganism that may be pathogenic from establishing a site of infection.
- N/B:Treatment of bacteria are by use of antibiotic.

FUNGI

- The study of fungi is **mycology.**
- The diseases caused by fungi is called **mycosis**.
- Fungi are microorganism that are incapable of producing their own food and live on decaying organic material.
- Structure-Fungi have along branching filament(hyphae) that branch and form a network which called mycelium
- Reproduction- produce sexually by spores where there is fusion.
- Also reproduce assexually by nuclei where there is no fusion.

CONT……

- **PATHOGENESIS.**
- Mycotic diseases/ fungal diseases-
  - Are caused by yeast and moulds.
  - Produce agglutination reaction in the host resulting in tissue granules.
  - Fungi generally don't produce toxin like bacteria.
- Groups of fungi- are four groups:
- Filamental fungi moulds
  - -Form branching tubular filament which are interwoven in to a mycerium.
  - They produce asexual spore of many kinds.
  - Moulds are the main source of antibiotic.

CONT.....

- Yeast-
  - are single round or oval cells.
  - Resproduce by forming small lateral buds that enlarge and develop in to new cells.
- Yeast like fungi-
  - medically important genus is called Candida which can reproduce by budding , the buds tend to elongate in to filaments which remain linked together in chain that have some resemblance to mould mycerium.
  - Common yeast ferment sugar to alcohol and raise bread during baking
- Dimorphic fungi-
- it has a yeast morphology in tissue of when growing cultures at 37degress.
- Usually pathogenic e.g. Candida albican.
- Beneficial fungi importance-
- Used in the production of yoghurt, cheese, beer and wine and drugs

CLASSIFICATION OF MYCOSIS

- Dermatomycosis(superficial)/ringworm.
- Subcutaneous mycosis.
- Demycosis /systemic mycosis.

DERMATOMYCOSIS.

- Involves only the following part: epidermis, hair, nails, which have dead keratinized tissues and is in the superficial layer of epidermis.
- They may represent an allergic reaction to fungi.
- It includes three main families.
- Tricophyton which does not attack the hair and attacks epidermis and nails.
- Epidermophyton does not attack nails and attacks epidermis and hair.
- Microsporum.

CONT……

- This three fungi are filamental and digest keratin by enzymes e.g.
- tinia-pedis(athlete- foot)
- tinia capitis(skull ringworm),
- tinia corporis,(body ring worm)
- tinia cruris(groin).
- tinia manuum(palm and side of sole of the foot),
- tinia ungium(toe and finger nails).

CONT.....

- Tinia pedis
  - Is common with peoples who wear closed shoe and grows in 4^{th} and 5^{th} toe and rise to inflammation and breaking of the skin.
  - Treatment you give topical and antifungal ointment and transmitted by shared showered services.
- Taenia capitis
  - Is the infection of the skin of the skull. Positive organism is microsporum and tricophytol.
- Taenia manuum and ungium
  - is common in dish washers and laundry workers.

CANDIDA ALBICAN

- Is a yeast like fungus and is opportunistic that live harmlessly on the skin and mucus membrane of the mouth , intestine and reproductive system.
- When the body has low immunity it trigger it to form oral thrash which affect the mucus membrane of the mouth or vagina candidacies.
- Also cause vulva vaginatis and common in adult female.

CONT.....

- **SUBCUTANEOUS MYCOSIS**
- They infect skin subcutaneous tissue and cause a chronic infection in the subcutaneous layer of the foot(mycetoma). It occur through the rakes of the skin by fungal spore from fungi in the soil or vegetation.
- **SYSTEMIC MYCOSIS-**
- Affect internal organs and major body systems and are caused by saprophytic fungi that grow in the soil and the spore are inhaled.
- Causative organism are histoplasma, Cryptococcus , blastomyces.

PROTOZOA

- Are single celled microorganism found in water and soil.
- Structure-
  - are unicell.
  - Complex.
  - organism may be spherical, spiral, spidal or cup shaped
- Motility-
  - They use pseudo pods which is a projection that move the organism forward.
  - The pseudo pod can either be flagella which are whip like projection or cilia which are short delicate projection in the outer surface of the organism.

PATHOGENIC GROUP

- Flagellate /mastigophora
  - Have one or more flagellus.
  - include the intestinal genital and genitourinary e.g. trychomonas vaginalis which is transmitted through coitus, giardia lambria,trypanosomes
- Sarcodina
  - Have amoeboid characteristic e.g. entermoeba histolytic.
- Sporozoa
  - Undergo a definitive life cycle that undergoes two different hosts.
  - One host is usually athropoid and other a vertebrate e.g. mosquito and man , plasmodium pneomocystic carinii.
- Ciliates/ ciliophora.
  - Have cilia and two nuclei.
  - are the most complex.
  - The intestinal ciliates in human is known as balantidium coli.

FLAGELLATES

- **Trychomonas vaginalis**
  - Found in genital tract of a male and female and has four flagella.
  - In male infection is commonly symptomless but their may be a white urethral discharge.
  - In female it cause frothy yellow or cream colored alkaline discharge .
  - It affects the vulva vagina and cervix.
  - Transmission is by sexual intercourse, direct contact of mucus.
  - It like acidic or alkaline environment and feed on white blood cells and bacteria remains.
  - They are commensals in intestines.

GIARDIA LAMBRIA

- Causes giardiasis.
- It is flagellate protozoa and its a common inhabitant of upper human intestine that is duodenum and jejunum.
- It is pear shaped and resembles human face with two nucleus as eyes or googles.
- It has eight flagella and transmitted through oral fecal route.
- Causes infection in gastrointestinal tract.
- Expelled in feces.

TRYPANOSOMES

- Also known as haemoflagellates
- Found in gland and transmitted by biting insect.
- All types of trypanosomes causes trypanosomiasis or sleeping sickness.
- **PATHOGENIC GROUP.**
- **Tryponosoma gambiense**
  - causes sleeping sickness and occurs in chronic form.
  - Its transmitted by tsetse fry called glossina palpilis

CONT.....

- Also known as African sleeping sickness.
- They live along the river banks where their thick wood.
- Commonly affected people are fishermen and women.
- It also called meningoencephalitis.

- **Trypanosoma rhodisiense-**
  - transmitted by tsetse fly called glossina morsitan.
  - Causes African trypanosomiasis and meningoencephalitis

CONT.....

- **Trypanosoma cruzi-**
  - Transmitted by birds and causes south American trypanosomiasis.
  - they multiply in tissue. insect become infected by biting human beings or animal e.g. cattle or antelopes.
  - When one is suffering from trypanosomiasis one get inflammation of lymph nodes, headache and fever.

PLASMODIUM

- It is haemo parasites found in blood cells .
- Are four species which are transmitted by female anopheles mosquito-
- **Plasmodium malarie-**
  - Causes quartan malaria where by fever recur every 72 hours.
- **Plasmodium vivax-**
  - Causes benign tertian malaria, the fever recur every 48 hours. The RBC LOOK ENLAGERD
- **plasmodium falciparum-**
  - **Causes malignant cerebral and tertian malaria.**
  - The affected red blood cell develop sickle cell.
  - Red blood cells agglutinate obstructing capillaries.

CONT.....

- **Plasmodium ovale**
  - Causes ovale malaria and fever recurs every 48 hours.
  - Red blood cell take oval shaped.
  - Vivax and ovale adopt parasitic change in the liver causing malaria to recur up one and a half years.

CONT.....

- Man is beaten by female anopheles mosquito in which tha parasite has completed their sexual cycle as follows
  - Entering human blood as a minute spidal shaped sporozoite.
  - The plasmodium pass to the liver where they develop in to large multicelullar schizoids usually after five to ten days of infection.
  - this schizoites develop in to many merozoites and is called preerythrolytic cycle before entering RBC
  - Some of the merozoits reenter the liver and the site is now called exoerythrolytic cycle.
  - Cycle is repeat over and over except in plasmodium falciparum

GAMETOCYTES

- This sexual forms are sucked by female anopheles mosquito.
- They fuse to form a zygote and the zygotes develops in to oocytes in the stomach walls.
- Mature oocytes rapture and release sporozoites which make their way in to the mosquito salivary gland, hence initiate fresh human infection.

TOXO PLASMO GONELLI

- Crescent shaped protozoa
- is an obligate intracellular sporozoa.
- The reservoir is rodents and domestic animals.
- It has oocytes that are shed by cat which can be inhaled.
- Transmission is by eating infected meat.
- Can be transmitted to the fetus through the placenta.
- Disease caused are still birth, microcephary or hydrocephary, encephalitis , congenital deformities and eye lesions.

LEISHMANIA PROTOZOA

- It resembles certain stages of trypanosome.
- It is flagellate occur in sand fly or artificial culture.
- Disease caused is leishmaniasis or kala-azar.
- Pathogenic type to man-
- Are three type which are transmitted by the sand fly of the genus phlebotamus.
- leishmania donovani.
  - it is protozoon.
  - The sand fly are immediate host and vector.
  - Causes visceral leishmaniasis.
  - Signs are high temperatures, splenomegally, hepatomegally and affected lymph nod and bone marrow.

CONT.....

- Leishmania tropica-
  - cause cutaneous leismaniasis where one have dry surface on the oral or anal mucosa.
  - it becomes an ulcer and heals slowly.
- Leishmania brazaliensis-
  - causes mucocutanus leismaniasis.
  - Occurs in south America and affect the mucus of the nose and pharynx
- Leishmania donovani
  - spread from the site of inoculation to the reticular endothelial cells e.g. spleen , lymph nodes , liver and bone marrow.
  - This brings about splenomegaly, fever and weight loss.

DIFFERENCES BETWEEN BACTERIA AND VIRUSES

bacteria	viruses
• Have cell wall • Large in size • Contain RNA and DNA molecules • Multiply by binary fusion • Grow in inanimate calture media • Have ribosome. • Are sensitive to antibiotic.	• Have envelope/ cupsid. • Small in size. • Contain either RNA or DNA molecules but not both • Replicate inside organism and animal • Cannot survive in inanimate calture media • Have no ribosome • Not sensitive to antibiotic.

VIRUS

- Infective agent smaller than bacteria.
- DNA and RNA are information molecules of a cell.
- DNA contain genetic information for the production of essential protein that will enable the cells to function properly.
- RNA is a nucleic acid necessary for protein synthesis.
- All the biological information the cell need for growth and reproduction is stored in DNA.
- Genetic material of most viruses is either double stranded DNA or single stranded RNA.
- Viruses vary in size, appearance and behavior.
- Complete infective particle of the virus is known as virion.
- Virion is protected by closed protein coat called cupsid.

REPRODUCTION

- Viruses are not complete cells there fore cannot reproduce by themselves. They attach to the permissive receptor of the host cell membrane and inject RNA or DNA which then takes control of the living cell.
- Viral genetic material is injected from the cupsid to the recipient cell through its tail.
- The viral particle does the following-
  - Alter protein synthesis.
  - Alter the gene of the host.
  - Causes chromosomal changes.
- The cell then synthesizes new viral protein and nucleic acid, the process continues until the cell raptures releasing new infective virions.
- The cupcid of the virus have various shapes.

Polyhedral -Many sided

- Helical(coil)
- Bullet shaped.
- Spherical
- Each facet has several cupsomeres.
- Some virus have 20 sites.
- The virus that infect the bacteria is called bacteriophages.

COMMON DNA VIRUSES

- Pox virus- cause small pox and cow pox
- Papilloma virus- cause warts, tumours and cancers .
- Herpes virus-
  - cause oral lesions cold soles, fever, blisters.
  - Herpes zooster- causes shingles which follows the nerve part of the body infected and common in HIV/ AIDS.
- Adeno virus- cause conjunctivitis, respiratory infection eg pharyngitis, running nose fever, pneumonia and some tumors.

RNA VIRUSES

- Toga virus
- Picorna virus
- Rheo virus
- Arbo virus
- retro virus
- Ebola virus
- Myxo virus

EBOLA VIRUSES

- Ebola is a river in Zaire and Ebola virus occurred as a haemorrhagic fever in Sudan and Zaire in 1976.
- In Zaire 200 people died out of 300 people while in Sudan 30 people died out of 70 people.
- It is transmitted through body contacts
- Once Ebola virus has been transmitted through contact of unknown reservoir they adopt themselves from direct to direct which introduce severe infection or out break.
- Is a filo virus of the family of filo viridae.
- It is an RNA and enveloped with a characteristic of filamental structure.
- It has four known strain or species
  - Zaire, Sudan, Reston and ivory cost.
- The actual distribution is unknown.
- In April 2001 Ebola virus occurred in Gulu district and was found to e caused by Sudan species.
- Transmission is contact from person to person or any organ of the infected person . Injuries with needle or handling body fluids with out protection, handling of dead bodies of suspected victim should be discouraged.

SIGNS OF EBOLA

- Bleeding in the gastrointestinal tract.
- Profuse diarrhea and vomiting.
- Headache and fever.
- Muscle pain.