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BASIC PATHOLOGY

SHORT NOTES

(EXAM POINTS)

(For 2nd year BAMS)

By

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INTRODUCTION TO PATHOLOGY AND ITS SUB-DIVISIONS

DEF: Pathos: suffering, **logos**: study. Thus the pathology is scientific study of changes (suffering) in the structure and function of the body in disease (impaired health) and it answers the disease in terms of its aetiology, pathogenesis, prognosis and treatment plan.

Lesion: Characteristics changes occurred in cell or tissue as the result of disease.

Aetiology: Causative factor

Pathogenesis: Mechanism by which lesion or disease produced

Prognosis: what is going to happen, curability or non-curability of the disease?

Diagnosis: Naming the disease or answer to the pathogenesis

Treatment: What can be done to disease?

Prevention: how to avoid the complications and spread of the disease

BRACHES: Mainly two **General pathology** (dealing with general principles of disease) and **Systemic pathology (**study of disease pertaining to specific organ or tissue.

- **Morphological Braches:**

1) **Histopathology:** Also known as **tissue pathology or anatomic pathology.** It includes **surgical pathology** (study of removed cell or tissue by biopsy), **Experimental pathology** (study of disease in experimental animal) and **forensic pathology** (study of organ removed from post-mortem)
2) **Cytopathology:** Study of cells shed off from lesion **(Exfoliative cytology)** and fine needle aspiration cytology **(FNAC)**

Haematology: Deals with disease of blood it includes **laboratory haematology and clinical haematology**

CELL INJURY

Cell Injury: As the effect of various stresses due to etiological agents a cell results in change in internal and external environment. It is reversible when stress is mild to moderate and irreversible when it is severe

Causes: Hypoxia (by blood loss), Physical agents (trauma, radiation etc), chemical agents and drugs, infectious agents, immunological reactions, Genetic, Nutritional imbalance.

Types: Reversible (Recovery of cell damage once stress removed) **and Irreversible** (No recovery / Cell death)

- **Reversible:** Occurred mainly due to **Alteration in plasma membrane** (i.e. Bleb formation, loosening of intracellular attachment and **steatosis:** means fat accumulation within cell), **Change in mitochondria (**Swelling or hydropic, rarefaction, phospholipids amorphous densities**), Nuclear change** (Disaggregation of granular and fibrillar element**)** and **ER changes** (Dilatation, detachment and disaggregation)
- **Irreversible:** Mainly occurred as the result of **Swelling of ER, Lysosomes rupture, nuclear condensation, nuclear lysis, Membrane blebs, and swollen mitochondria with amorphous densities.**

  The irreversible is mainly of two types **Necrosis and Apoptosis**

  NECROSIS: It is death of localized area of tissue followed latter by degradation of tissue by lysosomal enzyme mainly occur in inflammation and in hypoxia.

  APOPTOSIS: also known as coordinated and programmed death of cell occurred mainly in pathological condition but not in inflammation

  Changes after cell death:

  - **Gangrene:** Putrefaction of necrosis**,** two types **dry gangrene** e.g. Buerger's disease, Raynaud's disease **and wet gangrene** e.g. Bed sore, diabetic foot
  - **Pathological Calcification:** Deposition of calcium salt in tissues other than enamel of tooth occur both in dead tissue and degenerated tissue

CELLUALR ADAPTATION

- Form of Reversible cell injury
- Capability of adjusting their structure and functions in response to various physiological and pathological stimuli (Mild to Moderate) is known as **cell or cellular adaptation**

TYPES:

1) **Physiological:** Occurs in response to an stimulus and ceases once the need of adaptation has ceased e.g. change in breast and uterus during **pregnancy due to influence of harmones**
2) **Pathological**: Occurs in response to injury or pathogens by producing **cell stress proteins**, which protect from damage and help in recovery
    - **Atrophy**: Reduction of cell size which result in shrinkage of cell or organ. Due to **degradation of cell protein** by lysosomal enzymes **e.g.** ischemic atrophy, disuse atrophy of muscle
    - **Hypertrophy**: Increase in the size of cells which result in enlargement of cell or organ. Due to increased production of **cellular protein, intracellular factor and growth factor e.g.** Left ventricular hypertrophy
    - **Hyperplasia**: Increased number of cells in an organ or tissue. Due to synthesis of **DNA** and **Proliferation** of cell by local production of growth factor **e.g.** Hyperplasia of endometrium and hyperplasia of prostate
    - **Metaplasia**: Replacement of one adult cell type with another. **Due to long time persist** of cause leads to Metaplasia by the influence of different factors like growth, cytokines etc. **e.g.** Squamous metaplasia, columnar metaplasia

      (Note: Both Hyperplasia and Metaplasia are fertile soil for the development of **malignancy** in future if cause or stimuli is not removed)

INFLAMMATION

Definition: It is a tissue response at microcirculation (At the site of injury) level to nonself injurious agents.

Types: different types based on different criteria

Criteria	Types	Definition
According to duration	Acute	Lasting for seconds, minutes or <48hrs
	Subacute or Chronic	Lasting >48hrs, days, weeks, months or years
According to histological feature	• Non specific (Majority of cases) • Specific (E.g TB, Leprosy and syphilis)	
According to causative factors	Aseptic	due to sterile chemical agents
	Aseptic	due to pathogens

Causes: Physical (Trauma, heat cold etc), **chemical** (Organic, inorganic poison**), Infective** (Bacterial, viral etc), **Radiation, immunological etc**

Mechanism of inflammation:

Vascular Changes: on injury there is **vasoconstriction** lasting for few seconds**,** and then there is a **vasodilatation** leads to excess blood flow to injured area

Cellular Changes: involvement of Polymorph nuclear cell, lymphocytes, macrophages and other WBCs

On injury there is **accumulation** of cells in peripheral side of vessels by means of **rolling**, then cells slowly **emigrate** into extra vascular space here they kills the infective agent by means of **phagocytosis**

- **Cardinal features:**

Redness: Due to excess flow of blood

Swelling: Due to accumulation of intravascular contents to interstitial space

Heat: Due to change in thermoregulation as the result of injury

Pain: due to peripheral nerve irritation by chemicals secreted on injury

TISSUE HEALING AND REPAIR

Healing is the process by which the cells in the body **regenerate** (replacement of dead cell by new cell) and **repair** (replacement of injured cell by scar tissue) to reduce the size of a damaged or necrotic area. Most of the injuries will heal using a mixture of both mechanisms.

Mechanism: The process of healing has following steps

- **Initial haemorrhage (Clotting phase):** As the result of injury the wound space filled with blood which then clots to stop bleeding and infection
- **Inflammatory phase:** occurs with 24hrs with appearance of polymorphs from the margins of incision by 3rd day these are replaced by macrophages
- **Proliferative phase (epithelial change):** Formation of epithelial spur over the area of incision by means of proliferating and migration of granulation tissue into type III collagen
- Maturation phase: unnecessary vessels formed in granulation tissue are removed by apoptosis, and type III collagen is largely replaced by type I. This phase can last a year or longer. Ultimately a scar made of collagen, containing a small number of fibroblasts is left.

EDEMA

Def: Abnormal and excess accumulation of free fluid in the interstitial space

Types:

a) Localised (Confined to organ or limb, e.g. allergic edema, pulmonary edema) **and Generalised** (when it is systemic in distribution also known as anasarca or dropsy e.g. renal edema, cardiac edema nutritional edema)

b) **Transudate** (fluid accumulated without change in vascular permeability protein content low e.g. cardiac and renal edema), **Exudates edema** (fluid accumulated due to change in vascular permeability protein content high e.g. inflammatory edema)

c) **Pitting** (formation of pit on pressure)**, Non-Pitting** (absence of pit on press)

Causes or mechanism:

Decreased plasma oncotic pressure, increased capillary hydrostatic pressure, Lymphatic obstruction, increased oncotic pressure of interstitial space, decreased hydrostatic pressure of interstitial space, increased capillary permeability, and Sodium water retention.

(**Note: Subcutaneous edema:** cardiac and renal failure**, lower eyelid edema:** renal disease**, elephantiasis:** filariasis**)**

SHOCK

Def: Also known as **cardiovascular collapse,** as the result of reduced circulating blood volume and or inadequate perfusion of cells and tissue.

Pathogenesis: All forms of shock involve: Reduced effective circulatory volume, impaired tissue oxygenation, Release of inflammatory mediators.

Types:

Hypovolaemic shock: due to acute haemorrhage, Burns, Excessive use diuretics etc

Cardiogenic shock: due to MI, Cardiac arrhythmias, pulmonary embolism etc

Septic Shock: Due to Gram negative and positive bacterial infection

Other shock: includes traumatic shock due to sever injury, neurogenic shock due to head injury

Clinical features: Low blood pressure, low body temperature, feeble pulse, pale face, shallow respiration and cold clammy skin

Stages: Reversible and irreversible stage of shock

HAEMORRHAGE

Def: Escape of blood from the rupture or non ruptured blood vessel is known as haemorrhage

Types:

- **Internal** (bleeding within body) and **external** (bleeding out of body**) haemorrhage,**
- **Acute** (sudden and massive bleeding) and **chronic** (small amount over a period) **haemorrhage**
- **Class I Haemorrhage** involves up to 15% of blood volume. There is typically no change in vital signs. **Class II Haemorrhage** involves 15-30% of total blood volume tachycardia, difference between the systolic and diastolic blood pressures. peripheral vasoconstriction. pale and be cool skin.. Blood transfusion is not usually required. **Class III Haemorrhage** involves loss of 30-40% of circulating blood volume, blood pressure drops, the heart rate increases, shock, diminished capillary refill, blood transfusion are usually necessary. **Class IV Haemorrhage** involves loss of >40% of circulating blood volume, aggressive resuscitation is required to prevent death.

Causes: Trauma to the vessel, inflammation of vessel wall, vascular diseases like atherosclerosis, aneurysm etc, elevated pressure within vessel, low platelet count, haemophilia etc,

Effect: the effect of blood loss depends on the amount, speed and site of blood loss. Up to 33% of sudden blood is fatal may cause death

THROMBOSIS (Clot)

Def: Process of formation of clot mass in circulation from the constituents of blood, the mass is called as clot or thrombus

Pathophysiology: Epithelial injury, plate abnormality, alteration of blood flow, abnormality of coagulation system

Types: **Venous thrombosis** (Deep or superficial vein) and **Arterial thrombosis**

The effect of thrombosis will depend upon their location, size and nature of thrombi

EMBOLISM

Def: It is the process of partial or complete obstruction some part of cardiovascular system by mass **(embolus)** carried in circulation**.** This embolus may be a blood originated **(thrombus)** or fat **(fat embolus)** or air **(air embolus)** etc**,**

Types:

- Venous, arterial, paradoxical (venous to artery)
- Solid, liquid and Gaseous embolism
- Bland (when embolus is sterile) and Septic (infected embolus)

ISCHAEMIA

Def: It is deficient blood supply to a part of tissue relative to its metabolic needs

Types: Complete ischemia and Partial Ischemia

Pathophysiology: Ischemia either due to Hypoxia (low oxygen, low haemoglobin, or low blood supply), Mall nourishment of cell and inadequate clearance of metabolites

Causes: Occlusion (due to thrombus or embolus), Trauma, Others (Atherosclerosis, hypoglycaemia etc)

INFARCTION

Def: It is the process of tissue death (necrosis) as the result of ischemia

Causes: Occlusion (due to thrombus or embolus), Trauma, Others (Atherosclerosis, hypoglycaemia etc)

Pathogenesis: As the result of injury or ischemia there will be slowly death of the cell or tissue as the result of changes in vascular and cellular level like irreversible form of cell injury

Types:

- Anaemic and haemorrhagic infarction
- Recent and old infarction

IMMUNITY

Def: The term immunity defined as resistance exhibited by the host against any foreign antigen including microorganisms.

Types: Innate and acquired immunity

Innate immunity: It is a resistance which individual possess by birth

- **Species immunity**: resistance to a pathogen shown by all members of particular species. E.g B. Anthracis infects human beings but not chickens.
- **Racial immunity:** within one species different races May exhibits differences in resistance E.g American negroes are more susceptible than white to tuberculosis
- **Individual Immunity:** Resistance to infection varies with different individual of same race and same species. E,g,Homogenous twins exhibit similar degree of resistance to Tuberculosis

Acquired immunity: The resistance acquired by an individual during life. Two types Active and Passive

- **Active**: resistance developed as a result of contact with an antigen; this contact may be in the form of natural infection or by vaccination

a) **Natural:** Through clinical or subclinical infection e.g: Post expose of small pox infection

b) Artificial: Induced by the vaccination e.g: By vaccine

- **Passive immunity:** It's induced in an individual by performed antibodies against infective agent or toxin

a)Natural: through transplacental maternal IgG antibodies e.g: Its transferred from mother to foetus

b)Artificial: Through antiserum injection e.g: Human ATS

- **Mechanism:** By the Involment of Humeral and cell mediated immunity

IMMUNE RESPONSE

Def: specific reactivity induced in a host following an antigen stimulus is known as immune response.

Types: Humoral or antibody mediated immune response and Cell mediated immune response

Humoral immune response (HMI/AMI):

- Mediated by macromolecules found in extracellular fluids such as antibodies, c-proteins and antimicrobial component
- Provides primary defense against most extracellular bacteria and viruses of Respiratory or GIT
- Participate in immediate hypersensitivity and certain autoimmune diseases
- In response to antigen (foreign body) first the **B-cell** converted into **Plasma cell** (Matured B-cell), these cells will produce different chemicals like antibody etc with the help of **T-helper cells**. These secreted chemicals will take part in immune response

Cell mediated immune response (CMI):

- Protects against fungi, viruses and intracellular bacteria
- Participate in Delay hypersensitivity and in certain autoimmune diseases
- Provide immunity against cancer.
- It works by the activation of **phagocytes, antigen specific cytotoxic T-lymphocytes** in response to antigen take part in immune response, here the antibodies are absent

BASIC KNOWLEDGE OF AUTOIMMUNE DISEASES

- Normally immune system recognized its own tissue and tissue antigen as 'SELF' and not produces antibodies against them
- Autoimmunity is a condition when body produces antibodies and immunologically component T-cells against self antigen leads to structural and functional damage of tissue and leads to autoimmune diseases

Autoimmune diseases: Classified into

- **Haemocytolytic diseases:** These conditions involve various cells of blood circulation**. E.g.** Autoimmune hemolytic anemia, leucopenia and thrombocytopenia
- **Localised or organ specific diseases:** Specific organs are target for autoimmune reactions. **E.g.** Grave's disease, Addison's disease, pernicious anemia etc

- **Systemic or non- organ specific diseases:** Immune system response against a variety of self antigen and involves damage to several organs and tissue system. **E.g.** Rheumatoid arthritis, SLE (systemic lupus erythemtosus)

Mechanism:

May occur either by **Humoral or Cellular** immune response against self antigen usually causes tissue damage or disease by **TYPE-II** and **Type-III** hypersensitivity. Sometimes there is **Type-IV.**

- The immune response can be arrested by immunosuppressive therapy

IMMUNE DEFICIENCY DISEASE

- Diseases produced when the defense mechanism of the host is impaired
- Two types mainly **primary immune deficiency diseases** and **secondary immune deficiency diseases**
- Primary immune deficiency diseases produce when abnormalities in the **development of immune mechanism**
- Secondary immune deficiency diseases produce due to consequence of some other **diseases, malnutrition, drugs** etc.
- These immune deficiency diseases involve specific abnormal (depression) immune functions- Humoral immunity, cell mediated immunity or both – or nonspecific mechanisms such as phagocytosis and complement system
- Primary immune deficiency diseases includes **Humoral immune deficiencies** (e.g. X-linked agammaglobulinaemia etc.), **cellular immune deficiencies** (e.g. Thymic hypoplasia etc.), **combined immune deficiencies** (e.g. ataxia telangiectasia etc.), **Disorders of complement** (e.g. complement component and inhibitor deficiencies) and **Disorders of phagocytosis** (e.g. chronic granulomatous diseases etc.)
- Secondary immune deficiency diseases includes **lymphoid malignancy, lymphatic leukemia AIDS, Hodgkin's lymphoma etc.**

HYPERSENSITIVITY

Definition: Hypersensitivity refers to a condition in which immune response result in excessive reaction leading to tissue damage, disease or even death in the sensitized host. Hypersensitivity occurs in individual who have had previous contact with the antigen or foreign substance

Priming or sensitizing dose: The initial contact sensitize the immune system by priming appropriate B or T lymphocytes it is known as primi or sensitizing dose

Shocking dose: Subsequent contact with the same antigen causes hypersensitivity is known as shocking dose

Allergy is most commonly used as a synonym for hypersensitivity. The term allergy means an altered state of reactivity to an antigen; it may include both protective as well as injurious immune response.

Classification: Hypersensitivity reactions are classified into two types**, immediate** and **delayed** types based on the time required by sensitized host to develop clinical reactions upon exposure to the shocking dose of the antigen

Comb and Gel classified hyper sensitivity reactions into four types **type-I to IV**

- **Type I** (Anaphylactic)
- **Type II** (Cytotoxic)
- **Type III** (Immune complex)
- **Type IV** (Cell mediated)

Type I, II, and III depend on the interaction of antigen with humoral antibodies and are known as immediate type of reaction and Type IV is mediated by T or B lymphocyte and it is delayed type of reaction

Difference between Immediate and Delayed Hypersensitivity

Feature	Immediate	Delayed
Onset and duration	Appears and recedes rapidly	Appears slowly in 24-72hrs and last longer
Immune response	Antibody and antigen mediated	Cell mediated (T-lymphocytes)
Passive transfer	Possible with serum	Possible with lymphocyte or transfer factor
Desensitization	Easy but short lived	Difficulty but long lasting
Induction	Antigens or haptens, by any route	By antigen injected intradermally or by

NEOPLASM (TUMOUR)

Neo means **new** and **plasia** means **growth**, so neoplasia means abnormal growth of tissue or organ. It is also known as **tumor**, the branch which deals about neoplasm is **oncology.**

Types: Benign (Non- Cancer, Non harmful) and Malignant (Cancer, Harmful)

Nomenclature: By adding the suffix **Oma –** to the cell types from which it arises for **e.g.** Fibrous tissue**: Fibroma,** Bone: **Osteoma,** epithelial: **Carcinoma,** Mesenchymal tissue**: Sarcoma**

Difference between Benign and Malignant Tumor

Features	Malignant	Benign
Capsulated	Non-Capsulated	Usually Capsulated
Rate of growth	Rapid, Expansile	Slow, Progressive
Metastasis	Present	Absent
Size	Usually large	Usually small
Surrounding tissue	invade	Compressed
Spread	Spread to other parts	Non-spread
Differentiation	Undifferentiated	Well differentiated
Treatment	Chemotherapy, Radiation	Surgery, Radiation

TNM classification of tumour (To know the spreading of tumour)

T- Tumor Size	**N-Number of lymph node involved**	**M- Metastasis**
T_0: No Tumor	**N_0:** No lymph node involved	**M_0:** Metastasis Absent
T_1: 2-3cm	**N_1:** lymph node of one region involved	**M_1:** Metastasis Present
T_2: <5cm	**N_2:** lymph node of two region	
T_3: 5-10cm		
T_4: any size with Involment skin, muscle or other structure		

NUTRITIONAL DISORDERS

- **Macro nutrients:** Required in large quantity e.g. Carbohydrate, Protein, fat etc
- **Micro nutrients:** Required in less quantity e.g. Vitamins and minerals
- An adequate amount of nutrients are required for the body to provide energy, if there is a over nutrition will cause over weight or obesity will responsible for many diseases like diabetes, hypertension, stone formation, degenerative diseases like OA, and increase the incidence of cancer.
- If there is Malnutrition then there will be growth retardation, mental illness, immunodeficiency disorders. It is occur in two form primary (Malnutrition due missing of one or all component) and secondary (due to mal absorption of component).

  Disorders of Micro Nutrients:

  - **Vitamins**: Vitamin A (Night blindness, reduced hair growth), Vitamin B_1 (wet and dry beriberi), Vitamin B_2 (Intestinal keratitis), Vitamin B_3 (Pellagra), Vitamin B_6 (Anaemia, convulsions), Vitamin B_{12} (Pernicious anaemia, nerve damage), Vitamin C (Scurvy), Vitamin D (Rickets, osteoporosis), Vitamin E (Nerve abnormality), Vitamin K (Defective blood coagulation).
  - **Minerals**: Calcium (OA, RA etc), Iron (Anaemia, sore mouth), Iodine (Goitre, Hypothyroidism, hair loss), Potassium (Hypokalemia, muscular weakness), Sodium (Hyponitremia, digestive disorders)

  Disorders of Macro nutrients:

  - **Carbohydrate:** Overweight, obesity, diabetes and cardiovascular diseases etc and due deficiency leads to mood swing, ketosis, reduced staming
  - **Fat:** deficiency increased the risk of atherosclerosis, behavioural problem, depression, cognitive decline etc

Proteins: deficiency leads to Kwashiorkor and marasmus

INFECTION

Infection is the lodgment and multiplication of a parasite in the body. All infection do not invariably result in disease

TYPES: Primary (Initial infection), **Secondary** (When body resistance is lowered by a preexisting infection, a new parasite set up an infection), **Cross infection (**When a patient already suffering from a disease acquires a new infection from another host), **Nosocomial infection (**Cross infection acquired in hospital), **Iatrogenic infection (**Physician or nurse induced infection resulting from drug therapy or investigating procedures), **Subclinical infection** (When clinical features are not apparent), **Latent infection (**Following infection, some parasites remain in the host in hidden form and produce disease when host immune is reduced), **Atypical infection** (Characteristic features are not present) and **Typical infection** (Characteristic features are present)

MODE OF TRANSMISSION: Infections spread from one host to another by a variety of mechanism. **Contact** (e.g. syphilis AIDA), **Inhalation** (e.g. common cold, whooping cough), **Ingestion** (Cholera, dysentery etc), **Inoculation** (e.g. Rabies virus inoculated directly by the bite of rabid animal), **Vectors** (e.g. flies, fleas, ticks, mites), **Transplacental** (through placental barrier and infect the fetus in utero known as **teratogenic infections**) and **Iatrogenic and laboratory infections** (Through injections, blood transfusions etc)

TYPES OF INFECTIOUS DISEASES: Localised and **Generalized**. E.g. **Bacteraemia** (Circulation of the bacteria in the blood), **Septicaemia (**Multiplication of the bacteria), **Pyaemia (**pyogenic abscess as the result of septicemia), **Endemic (**The disease constantly present in a particular area e.g. enteric fever), **Epidemic (**The disease that spreads rapidly, involving many persons in a particular area at the same time e.g. Meningococcal meningitis), **Pandemic (**It's an epidemic that spreads through many areas of the world involving very large number of persons within a short period e.g. cholera, influenza etc)

CLASSIFICATION OF BACTERIA

Bacteria of medical importance measures **2-5 um (L) * 0.2-1.5 um (W)**

A) Depending on their shape:

1) **Cocci** *oval or spherical* shape **Diplococci:** Arranged in pairs, **Streptococci:** Arranged in chains, **Staphylococci:** Arranged in cluster or group, **Tetrads:** Group of four cocci **Sarcina:** Group of eight cocci
2) **Bacilli:** rod shaped, **Coccobacilli:** Length of bacteria is approximately same as width e.g. *Brucella,* **Streptobacilli:** These bacilli are arranged in chains e.g. *Streptobacillus***, Chinese latter or cuneiform pattern:** Arranged at angels to each other e.g. *Corynebacterium***, Comma shaped:** Curve appearance e.g. *Vibrio*, **Spirilla:** Rigid spiral form e.g. *Spirillum*
3) **Spirochaetes**: (*spiera: coil; chaite; hair*): These are slender, flexuous spiral forms e.g. *Treponema.*
4) **Actionomycetes:** *(Actis: ray. Mykes: fungus):* These are branching filamentous bacteria resembling fungi. They have a rigid cell wall.
5) **Mycoplasmas:** Cell wall deficient bacteria hence don't possess a stable shape**.** They are very small in size (50-300nm in diameter)
6) **Rickettsiae and Chlamydiae:** These are very small and obligate parasites. Due to their inability to grow outside living cells,

B) Based on Gram stain: Gram positive Bacteria: e.g. *Streptococcus, Staphylococcus, and Pneumococcus.* **Gram negative Bacteria: e.g.** *Salmonella typhi, Vibrio cholera*

C) Based on Acid fast stain: Acid fast stain Bacteria: e.g. *M.Tuberculi, M. Leprae.* **Non acid fast stain Bacteria: e.g.** *C. Diphtheria, Bacillus*

D) Based on Spore: Sporing Bacteria: e.g. *Bacillus, Clostridium* **, Non sporing Bacteria: e.g.** *Streptococcus, staphylococcus etc*

E) **Based on motility*:* Motile Bacteria: e.g.** *Salmonella typhi,* **Non motile Bacteria: e.g.** *Strepto and Staphylococcus*

CLASSIFICATION OF FUNGUS

Study of fungi is known as **Mycology**, All fungi are eukaryotic, their cell wall contain chitin, mannan and other polysaccharides, They divide asexually, sexually or by both processes

Classification of fungi: Fungi are kept under phylum Thallophyata

Taxonomical Classification: Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes

Morphological classification: Yeast, Yeast like fungi, Moulds, Dimorphic fungi

a) **YEAST:** Round to oval unicellular fungi**,** Reproduced by budding

b) **YEAST LIKE FUNGI:** These are partially grows as yeast and partially as chains of elongated budding cells joined end to end forming pseudophytes. Example is Candida albicans

c) **MOULDS:** They grow as branching filaments called hyphae usually 2-10um in width. Hyphae may be septate or non-septate, They reproduced from both sexual and asexual spores, Dermatophytes, aspergillus, penicillium are examples for moulds

d) **DIMORPHIC FUNGI:** They exist as yeast in the host and in the culture at 37^0c and as moulds forms in the soil and in the cultures at 22-25^0c, Blastomyces, dermatitidis, etc are the examples

- Diseases of fungus are known as **MYCOSES** mainly classified into, Superficial mycoses, Subcutaneous mycoses, Systemic mycoses,

CLASSIFICATION OF VIRUSES

The viruses are classified into different types

B/o Nucleus: DNA and RNA virus

B/o Symmetry: Helical and complex

B/o Envelop: Capsid and non capsid virus

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