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MEDICAL AND HEALTH SERVICE DEPARTMENT,
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UTTAR PRADESH PUBLIC SERVICE COMMISSION

VOLUME – 2

MICROBIOLOGY, FUNDAMENTAL
OF NURSING



CONTENT

MICROBIOLOGY

1. Bacteria	1-6
2. Sterilization	7-12
3. Immunity	13-15
4. National Immunization Schedule	16-17
5. Stoning Procedure	18-20

FUNDAMENTAL OF NURSING

1. Introduction	21
2. Acid – Base Balance	22
3. ABG Analysis	34-37
4. Enema	38-48
5. Vital Sign	
➤ Temperature	49-50
➤ Thermogenesis/lysis	50-52
➤ Fever	60-64
➤ Pulse	65-70
➤ Respiration	71-74
➤ Blood Pressure	75-79
➤ Pain	80-81
6. Nursing Process	82-89

7. Health Assessment	90-96
8. Drug Administer	97-99
9. Drug Calculation	103-108
10. Injection	108-112
11. Rights	113-114
12. Positions	114-123
13. Cardio – Pulmonary Resuscitation (CPR)	124-129
14. Foreign Body Airway Obstruction	130
15. Bio – Medical Waste Management (BMWM)	131-135
16. Antidotes	136-138
17. IV Therapy	139-143
18. Cannula IV	143-150
19. Hot & Cold Application	150-156
20. Sitz Bath	157-159
21. Medical – Surgical Asepsis	159-162
22. Sterilization	164-169

NUTRITION

1. Introduction	170-171
2. Carbohydrates	172-175
3. Proteins	176-181
4. Lipids	182-183
5. Fatty Acids	184-187
6. Vitamins	188-210
7. Minerals	211

Microbiology

Father of Bacteriology → Robert Koch



He also discovered → Tuberculosis Bacteria & Vibrio cholerae

It also gave Koch phenomenon that was an expression of Hypersensitivity reaction of tuberculosis Bacteria.

He suggested a criteria before Blaming to Organism for disease. This criteria was K/As Koch postulate

Bacteria ⇒ They are prokaryotes, unicellular
⇒ They have both DNA & RNA
⇒ They don't possess Chlorophylls
⇒ They are capable to possess normal life process like growth, metabolism and Reproduction

* Bacteria was classified under third kingdom K/As protista (By Haeckel)

- (1) prokaryotes
- (2) Eukaryotes

Difference

	features	prokaryotes	Eukaryotes
(A)	<u>Nucleus</u>		
(1)	Nuclear Membrane	Absent	present
(2)	Miotic Division	Absent	present
(3)	DNA	Circular	Linear
(4)	Histone	Absent	present
(5)	cytoplasm	Absent	present
(6)	Cytoplasmic Streaming	Absent	present
(7)	Mitochondria	Absent	present
(8)	Lysosomes	Absent	present
(9)	Golgi apparatus	Absent	present
(10)	Endoplasmic Reticulum	Absent	present
(11)	Centrioles	Absent	present
(12)	Ribosomes	present	present
(B)	<u>Chemical Composition</u>		
(1)	Sterol	Absent	present
(2)	Muramic Acid	present	Absent
(C)	<u>Miscellaneous</u>		
(1)	Flagella	Absent	present
(2)	pilli	present	Absent

Classification of Bacteria

on the basis of morphology

(1) Cocci



* Spherical shape

(a) III

* Cluster arrangement
(like bunch of grapes)

eg - Staphylococci

* Chain-Arrangement

eg - Streptococci

* pair Arrangement

Eg - Diplococci

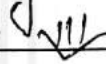
* Tetrad Arrangement

* Sarcina - group of eight

(2) Bacilli



* Rod cylindrical shape



* Cocco Bacilli → Same in length and width eg - Brucella

* Chinese Letter arrangement
eg - Corynebacterium

* Coma shape → eg - Vibrio cholerae

* Actinomycetes → Resembles as radiating sun rays

* Spirochetes → Spiro means spiral

Cheats means hair like

* Mycoplasma



They don't have stable structure
they don't have rigid cell wall
they are flexible.

Bacterial Anatomy

↓ ↓ ↓
Bacteria is unicellular, it is made up of following structure.

(1) Capsule →

It is gelatinous secretion of Bacteria that make a protecting covering of Bacteria.

It is not necessary that every bacteria has capsule. ~~many~~ many of bacteria are non-capsulated.

Usually the capsulated Bacteria are non-motile.

(2) Cell-wall ⇒ It is ~~porous~~ porous elastic membrane that is highly permeable to the solute.

Thickness ⇒ 10-20 μm

(3) Functions ⇒

- (1) provides shape to bacteria
- (2) provides rigidity to bacteria
- (3) provides support to bacteria
- (4) Helps in division in bacteria
- (5) Helps in adhesion to the Complement

(3) Cytoplasmic membrane ⇒

It is thin elastic

membrane that is semipermeable. It lies just beneath the cell wall.

It separates the cytoplasm to cell wall.

Chemically it is made up of phospholipids & proteins.

Functions → (1) Active & passive transportation
(2) Synthesis of cell wall
(3) Provide mechanical strength to bacteria
(4) Helpful in DNA replication

(4) Cytoplasm →

It is a suspension of organic and inorganic solutes in a watery solution.

It has the following structure

Ribosomes → These are granules distributed in whole cytoplasm

Responsible for → protein synthesis.

Mesosomes → Multi-laminated vacuoles found in the cytoplasm

Polysomes → These are groups/bundles of ribosomes joined together by strand DNA.

Nucleus → It is a coiled and filamentous structure of DNA. It has no nuclear membrane.

(5) Flagella

They are thick long filamentous appendages arises from cytoplasmic membrane.

There are 2 parts of flagella

- (1) Basal Body
- (2) A Hook

Flagella is active in only motile Bacteria
It is non-function in non-motile

Function → They are organ of motility.

Arrangement of Flagella



- (1) Monotrichaete → one flagella at one end
- (2) Apitrichaete → one flagella at both end
- (3) Lophotrichaete → A tuft of flagella one side of Bacteria

pilli (fimbria) → Thin hair like appendages projected from cell wall



Function → (1) Organ Adhesion
(2) Haemagglutination

Sterilization (Disinfection)

It is a process by which an instrument is freed from micro-organism [Both pathogenic and non pathogenic]

Disinfection → It is process of destruction of micro-organism which capable to rise infection.

Antiseptic → prevents growth of micro-organism

Bacteriostatic → prevents the multiplication of Bacteria

Bacteriocidal → It kills the bacteria.

* Methods of Sterilization and Disinfection

(1) physical Method

↓
Sunlight
Drying
Dry Heat
Moist Heat
Radiation
Filtration

(2) Chemical Method

↓
Acid and Alkaline
Oxidizing Agent
Halogens
Formaldehydes
Soap & detergents
Phenol
Dye
Vapors
Alcohol

(I) Physical Method

(A) Sunlight ⇒ Traditional method of Sterilization

It acts as a bactericidal Bcoz of UV rays.
 ⇒ Useful in Sterilization of blankets, room, water of rivers etc.

(B) Drying ⇒ Also natural Method
 ↳ Not a reliable Method of Sterilization

(C) Dry Heat ⇒
 It is a method of Sterilization in which articles are placed in following dry heat which cause bactericidal activity.

Types of dry Heat

<u>Red Heat</u>	<u>Flamming</u>	<u>Incineration</u>	<u>Hot air oven</u>
In this Method articles are placed in flame and allow them to become red Hot	In this Method articles are passed just over flame just allowing them to be Red Hot Eg → Mouth of test tube, Glass slide, Cotton woods	Method of Sterilization by a Higher temp. of dry Heat Eg → waste of Human Body, Soiled Dressing	Articles are placed in Higher temp of dry Heat for 1 Hour that cause Sterilization Mechanism

(D) Moist Heat \rightarrow It is also method of sterilization. Sterilization by moist heat may be following:-

Types

(1) Below 100°C Temp.

(A) pasteurization \rightarrow This method used to sterilization of milk.

Two Method

(i) Holder Method

(ii) Flash Method

$\downarrow\downarrow\downarrow$
Temp. 62°C for 30 min

$\downarrow\downarrow\downarrow$
 73°C for 15-20 Sec.

After this immediate instant cooling process is required.

(b) vaccine. Bath \rightarrow Method of sterilization of vaccines at 60°C for 1 Hour.

(2) A 100°C Temp.

(A) Ryndallization

(B) Boiling

$\downarrow\downarrow\downarrow$
In this process media like serum media, egg media are sterilized.
Temp $\rightarrow 100^{\circ}\text{C}$ for 30 min 3 days

$\downarrow\downarrow\downarrow$
By this process non-pathogenic Bacteria may be killed but spores remain unaffected.

(3)
IMP

Above 100°C Temp.

↓
Autoclave

↓
Most reliable method of sterilization

Temp. → 121°C

Pressure → 15 lb/inch²

For 15-20 Min.

Eg → Surgical equipments, gowns etc.

(D) Radiation → It includes

↓

Uv Rays → Bactericidal effect

Gamma Rays → also used for sterilization

↓

Radiating range in 2.5 mrad

Eg → Bone Graft

skin Graft

(E) Filter Method → used for sterilization

↓

Basically filter are made up of nitrocellulose membrane

Eg → Antibiotics, liquids, paraffin

(2) Chemical Method

(i) Acid & Alkaline \Rightarrow They are bactericidal and some antiseptic

eg \rightarrow Boric acid

(ii) Metallic ions \rightarrow $HgCl_2$, $AgNO_3$ are metallic ions
 \Downarrow
which are used for sterilization purpose.

(iii) Halogens \Rightarrow They are salt forming substance
 \Downarrow

Three types of Halogens

(1) Iodine

(2) Bromine

(3) Chlorine \rightarrow water disinfection

(iv) Oxidizing \Rightarrow

$KMnO_4$ mostly used oxidizing agent

(v) Formaldehyde

\Downarrow

It is used for disinfection and sterilization of woolen, blankets, infected room & operation theater.

\Rightarrow For 100 cubic feet area 50ml of 40% formaldehyde is used

The area should be air tightened or closely properly

(vi) Soad & Detergents \Rightarrow

(weak ~~ster~~ Disinfectant)

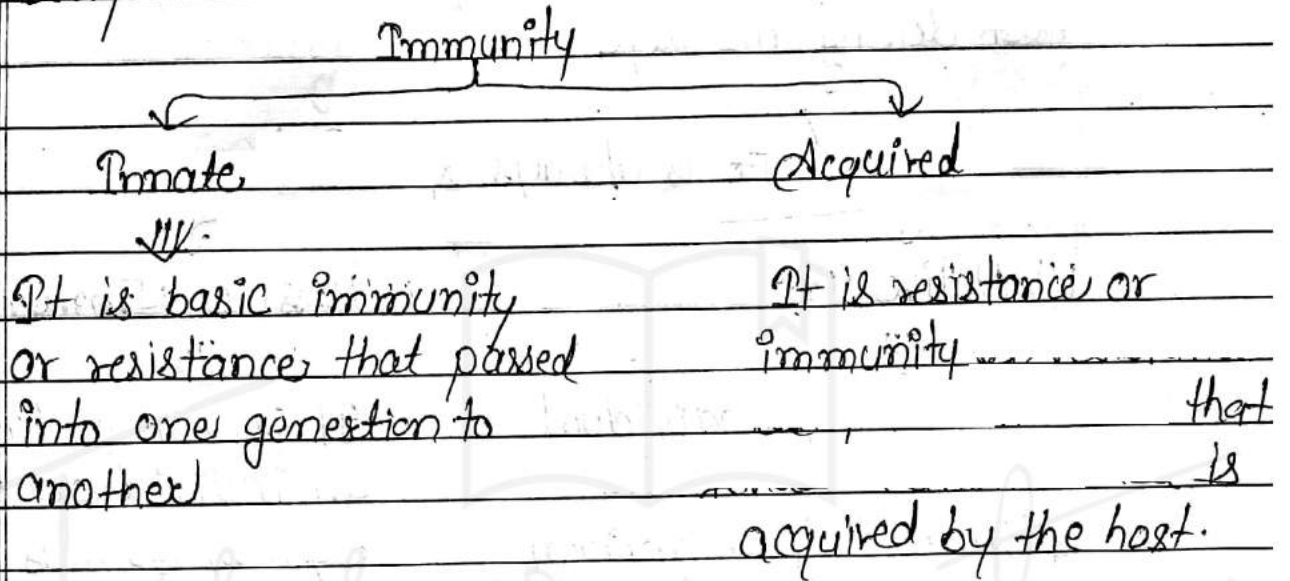
(vii) Alcohol \rightarrow 70% ethyl alcohol is used for disinfection. It is more useful than 100% alcohol.

(viii) Dye \Rightarrow Gentian violet and malachite green are dyes which are used for sterilization.

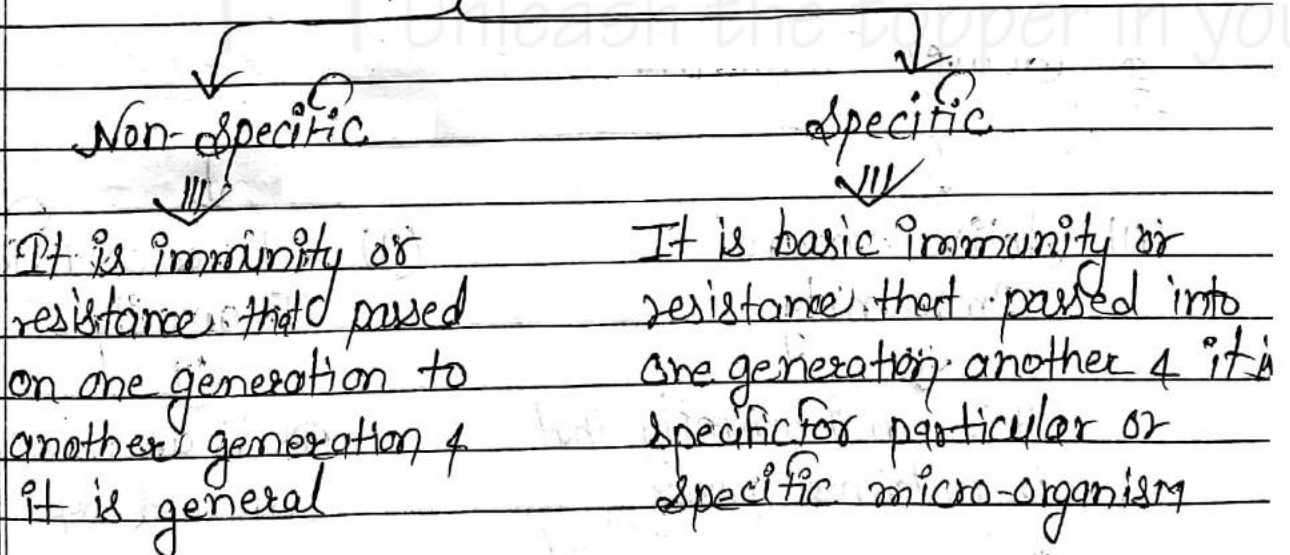
(ix) Vapors \Rightarrow Formalin vapors are used for disinfection of infected room O.T and infected cloths of pt.

Immunity

* It is resistance that is produced against the micro-organism and is produced by the body.



(1) Natural / Native / Innate Immunity



Types → (1) Species
(2) Racial
(3) Individual

Eg → Immunity against M. Tuberculi.

(2) Adaptive/Acquired Immunity

It is resistance or immunity that is not entertained but it is acquired or adopted by host during his life.

(It is always specific)

i) Active Immunity

Obtained by individual immune system by stimulating of antigen

ii) Passive Immunity

It is not produced by an individual's immune system so it is obtained as in ready form or other sources

* Active Immunity

(A) Active Natural Immunity

It is an immunity that is obtained following an antigen entry or clinical infection

Eg → Measles

(B) Active Artificial Immunity

It is an immunity obtained by vaccinations.

* passive Immunity

(A) passive Natural Immunity

It is an immunity that is obtained from mother during fetal life or by Breast milk.

(B) passive Artificial Immunity

It is an immunity that is obtained by readymade Immunoglobins and antitoxins.