

# General Microbiology

Topic Notes: 17

## General Microbiology

### Scientists

Anton Von Leeuwenhoek [Father of microscopy]

- Simple microscope

Louis Pasteur [Father of microbiology]

- Vaccination [CAR Vaccines]
- Sterilization [Hot air oven and autoclave]
- Fermentation of sugars
- Germ theory of disease
- Liquid culture media

Paul Ehrlich [Father of chemotherapy]

- Salvarsan [To treat syphilis]
- Acid fast staining [Modified by Ziel and Neelson]
- Standardise toxin and antitoxin

Robert Koch [Father of Bacteriology [Modern microbiology]

- Solid culture media
- Isolated bacteria [CAT = Cholera, Anthrax, TB]
- Hanging drop [demonstrate motility]
- Staining procedure [Aniline / Basic dyes]
- Koch postulates

Ignan Semmelweis [Father of Infection control]

- Hand washing

Joseph Lister [Father of Antiseptic surgery]

- Disinfectant [Pheno / Carbolic acid]

### STERILIZATION AND DISINFECTION

05:49

Sterilization

↓

Killing all forms of life + spore forms

↓

Agents called as sterilants

# General Microbiology

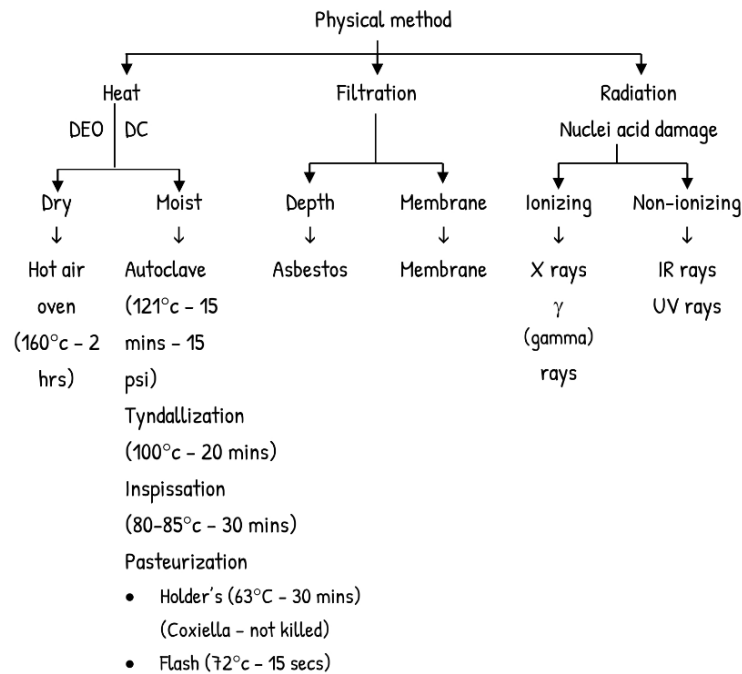
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Disinfection  
 ↓  
 Killing all forms of life except spores  
 ↓  
 Agents used for surface disinfection = Disinfectants  
 Agents used for skin disinfection = Antiseptics

## METHODS

06:49

- Physical methods = Physical agents used  
 ↓  
 All sterilants
- Chemical methods = Chemical agents are used  
 ↓  
 Sterilants  
 Disinfectants  
 Antiseptics



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DEO = Denaturation of proteins, electrolyte imbalance, oxidative damage

DC = Denaturation and Coagulation of proteins

### HOT AIR OVEN

10:30

Biological control → *Bacillus subtilis* [spores]  
*Bacillus atrophaeus*

Materials sterilized

Glass → Flask, pipette

Sharps → Scissors, forceps

Oil → Liquid paraffin

Powder → Glove dust powder

### AUTOCLAVE

11:57

Biological control → Geo - *Bacillus stearothermophilus*

Materials

Culture media → All except serum / egg containing media  
[Inspissation, Tyndallization]

Surgical instruments → All sutures except catgut suture  
[except sharps] [Ionizing radiation]

↓

Hot air oven

Disposable → Gloves, Foley's catheter, Syringes

Filtration → Membrane filters are most commonly used.

Uses

- Serum, Vaccines, Antibodies  
(Bacterial membrane filters)

↓

- To isolate bacteria  
(Mask filters)

↓

- Surgical masks & N-95 masks  
(HEPA & ULPA filters)

↓

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- Bio safety cabinets.

Radiation

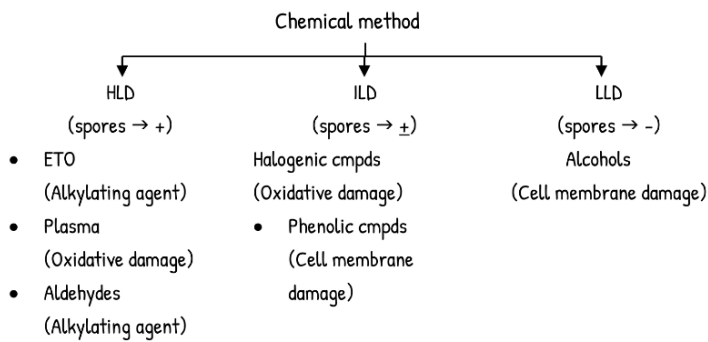
Biological control → *Bacillus pumilis* spores

Materials sterilized

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>✓ Ionizing radiation<br/>(High penetrating power)</li> <li>X/γ rays (gamma)</li> <li>↓</li> <li>Disposable [rubber &amp; plastic]</li> <li>Catgut sutures</li> </ul> | <ul style="list-style-type: none"> <li>✓ Non - Ionizing radiation<br/>(Low penetrating power)</li> <li>IR/UV rays</li> <li>↓</li> <li>Biosafety cabinets</li> </ul> |
|---|---|

CHEMICAL METHODS

16:24



HLD → Kills spores

ILD → Kills spores only at special circumstances (at high temp)

LLD → Does not kill spores

ETO (Ethylene oxide)

Biological control → *Bacillus subtilis*  
*Bacillus atropheus*

Materials

- Surgical instruments
- Disposables (Plastic and Rubber) → Highly toxic, inflammable, carcinogenic
- Heart lung machine → ↓ Aeration 8-10 hrs  
To remove residual ETO

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- Ventilator
- Dialysis machine
- Dental equipment

Plasma [ $\text{H}_2\text{O}_2 \rightarrow \text{Ions}$ ]

Biological, control: *Geo - bacillus stearothermophilis*

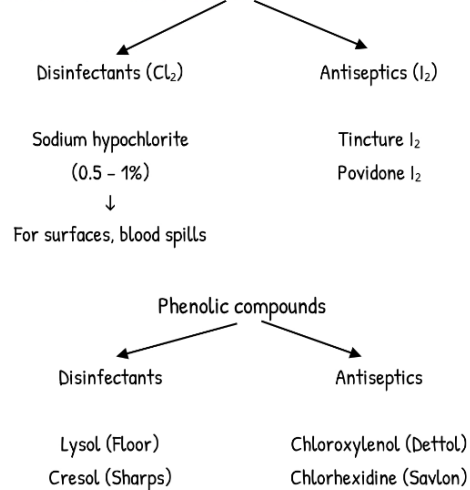
Materials

Corrosion - susceptible = Metal alloys

Electrical devices

## HALOGENIC COMPOUNDS

20:09



Aldehydes → Disinfectant

- Formaldehyde (40%) → OT sterilization  
(Gas) (Not used nowadays)
- Glutaraldehyde (2%) → Endoscopes
- Ortho-pthal-aldehyde → Endoscopes (better)

Alcohols.

Ethyl alcohol (70%) → hand rub, metal surface

Isopropyl alcohol (70%) → hand rub, thermometer

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### TESTS FOR DISINFECTANTS

22:38

Reference disinfectant → Phenol

- Rideal walker  
↓  
Efficacy = in absence of organic matter (eg: Stool samples)
- Chick martin  
↓  
Efficacy = in presence of organic matter [Better]
- Kelsey sykes  
↓  
Capacity → To retain its efficacy even after repeated use.
- Kelsey Maurer's in use test  
↓  
Contaminants → of a disinfectant

### SPAULDING CLASSIFICATION OF MEDICAL DEVICES

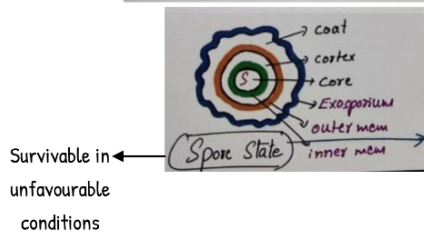
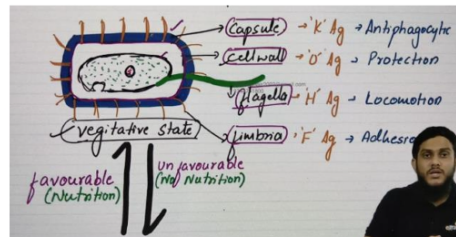
25:03

- 1) Critical = Penetrates mucous memb (or) enters surgical site → HLD  
↓  
IV catheters  
Surgical instruments
- 2) Semi - critical = Comes in contact with mucous memb (or) injured skin → HLD  
↓  
Endoscopes
- 3) Non - critical = Comes in contact with intact skin → ILD / LLD  
↓  
Stethoscope, sphygmomanometer

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## MORPHOLOGY & GROWTH OF BACTERIA



## DEMONSTRATION METHODS

32:18

### Capsule

#### 1) Microscopic

- Negative staining = Indian ink, Nigrosin
- Mc. Fayden's reaction = Methylene blue

↓

Stains only polypeptide capsules (eg: Bacillus Anthracis)

#### 2) Immunological methods

- Latex agglutination test (LAT)
  - Rapid test
  - By using anticapsular Ig coated on Latex
- Quellung's reaction
  - Detect only polysaccharide capsule

↓

Pneumococcus

Meningococcus

H. Influenzae b

Klebsiella

- Anticapsular Ig reacts to produce capsular swelling

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### Cell wall

- Electron microscope
- Micro dissection
- Plasmolysis

### Fimbriae

- Electron microscope
- Hemeagglutination

### Flagella → Demonstration

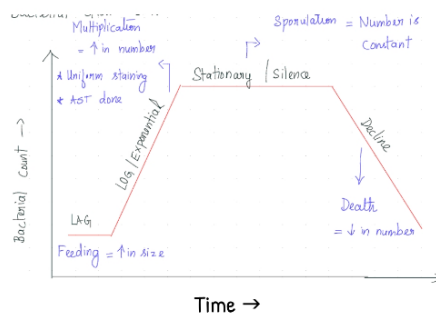
- 1) Direct methods → demonstrates flagella directly
  - a) Electron microscope
  - b) Flagellar staining  
[Tannic acid staining (Leifson's stain)]
- 2) Indirect methods → demonstrates motility
  - a) Wet mount
  - b) Hanging drop
  - c) Dark field microscope
  - d) Phase contrast microscope
  - e) Semisolid agar
  - f) Anti H antibody

### Spore

- Acid fast staining
- Ashby's methods
- Fluton's method
- Ryu's method

## BACTERIAL GROWTH CURVE

39:00



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## MICROSCOPY AND STAINING




42:14

### Microscopes

- Magnifying instrument

Unaided eye	Light microscope	Electron microscope
↓	↓	↓
0.2 mm	0.2 μm	0.2 nm
		[0.1 - 0.5 nm]

### Types

- 1) Simple microscope
  - Only 1 magnifying lens
- 2) Compound microscope
  - >1 magnifying lenses placed at some distance
    - ↓
    - a) Bright field microscope [Light microscope]
      - Staining
      - Wet mount and hanging drop [without staining]
    - b) Dark field microscope
      - Dark field condenser
      - No staining  → Background made dark  
→ Thin, live spirochetes
    - c) Phase contrast microscope
      - Phase plate
      - No staining  → Organism made dark  
→ Thin, live spirochetes
    - d) Fluorescent microscope
      - Fluorescent dyes  = UV light used
    - e) Electron microscope
      - Heavy metal staining = electrons used for magnification

## STAINING

47:51

- ↑ visibility of organism

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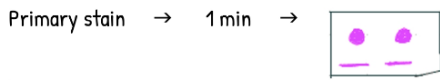
- Kills the organism

**GRAM STAINING**

48:30

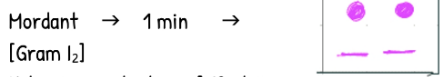
- To differentiate bacteria into Gram +ve and -ve

Steps:



[Crystal violet  
Methyl violet  
Giemsa violet]

↓ Wash



[Gram I<sub>2</sub>]

Helps in penetration of 1<sup>o</sup> stain

↓ Wash

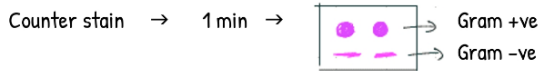
Decolourizer

Acetone → 2 - 3s →

Acetone alcohol → 10 - 30s

Critical step

↓ wash



Gram +ve

Gram -ve

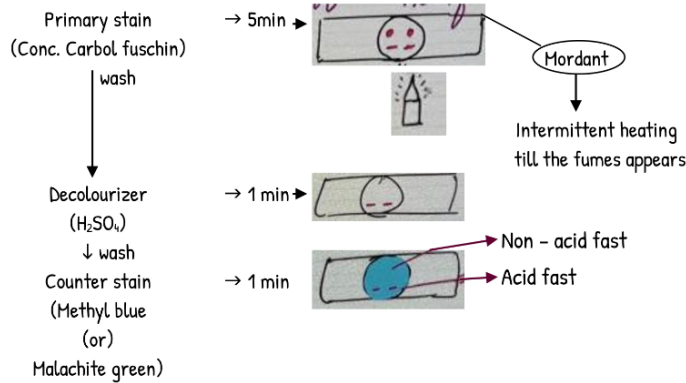
[Saffranin

Dilute carbol fuschin]

**ACID FAST STAINING**

51:11

Acid fast staining → to differentiate bacteria into Acid fast & non - acid fast




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## Albert staining

- To demonstrate metachromatic granules

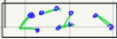
Albert's A solution → 5 mins → 

[Malachite green

And

Toluidine blue]



Albert's B solution → 2 mins → 

[Alber's I<sub>2</sub>]



Mordant

## IMPREGNATION STAINING

56:36

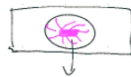
- To demonstrate thin organism, structures

a) Tannic acid staining

Eg: Leifson's staining



To demonstrate flagella



Stained flagella

b) Silver impregnation staining

Eg

o Warthin starry staining



To demonstrate H. pylori



Black comma shaped

o Fontana staining



To demonstrate spirochetes



Brown color spiral shaped

## NEGATIVE STAINING

57:52

- To demonstrate capsule

• Negative stains a) Indian ink



Clear halo with dark ✓ backgrounds

b) Nigrosin

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## CULTURE MEDIA AND METHODS

58:33

### Culture media

#### 1) Based on O<sub>2</sub> requirement

- Aerobic media → presence of O<sub>2</sub>

↓

Blood agar, Mc Conkey agar

- Anaerobic media → absence of O<sub>2</sub>

↓

RCM broth, Thioglycollate broth

#### 2) Based on consistency

- Solid media = with 2% agar

↓

Blood agar, Mc Conkey agar

- Semi - Solid media = with 0.5 - 1% agar

↓

Mannitol motility media

- Liquid media = No agar

↓

Thioglycollate broth, Alkaline peptone water

#### 3) Based on constituents

- Simple / Basal media

↓

Nutrient broth, Nutrient agar

#### • Special media (Special Constituents added)

##### 1) Enriched media

↓

Blood agar, chocolate agar

##### 2) Enrichment media

- Only for stool sample

↓

Selenite F broth (SLF)

Tetrathionate broth (TTB)

} → For all stools except vibrio

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Alkaline peptone water (APW) → for Vibrio

### 3) Differential media / Indicator media

Eg: Mc Conkey agar

- Into LF Vs NLF
- G +ve are inhibited
- Swarming is promoted

### Cysteine Lactose – Electrolyte Deficient media

- Into LF vs NLF
- G +ve also grows along with G -ve
- Swarming is inhibited

### iv) Transport media

- Ex: Pike's media → Streptococcus  
 Annies / stuart's media → Gonococcus  
 Clairy Blair media → All stool pathogens  
 Buffered Glycerol Saline → All stool pathogens except vibrio & campylobacter

### v) Selective media

- Ex: Mannitol salt agar → Staphylococcus aurea  
 Thayer martin media → Nisseria  
 Wilson Blair → Salmonella  
 TCBS → Vibrio  
 LJ → M. TB

## CULTURE METHODS

01:05:38

### 1) Routine culture methods

#### a) Streak culture

- With inoculation loop



#### b) Lawn (or Carpet culture)

- With cotton swab
- AST



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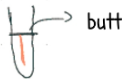
## c) Stroke culture

- With inoculation wire



## d) Stab culture

- With inoculation wire



## 2) Anaerobic culture methods

- Mc Intosh fildes's agar
- Gas pack
- Glove box
- PRAS
- Anaxomat (automated)

## IDENTIFICATION

01:11:10

- 1) Biochemical reaction
- 2) Molecular methods
- 3) Immunological methods

### Biochemical reactions

- Chemical reaction
- Catalase, oxidase
- MR, VP
- Indole, Mannitol motility, TSI, citrate, urease

### Catalase -ve (7)

- Streptococcus
- Pneumococcus
- Enterococcus
- Cardio bacterium
- Eikinella
- Kingella
- Shigella dysenteriae  
Type - 1

### Oxidase +ve (12)

- Meningococcus
- Gonococcus
- Pseudomonas
- Vibrio
- Campylobacter
- Helicobacter
- Hemophilus
- Bordetello
- Brucella
- Cardio bacterium
- Eikinella
- kingella



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c) Transformation



Free transfer

d) Transposition



By transposons

2) Mutation



Mycobacteria

## ANTIMICROBIAL SUSCEPTIBILITY TESTING [AST]

01:23:40

Methods

1) Phenotypic methods

a) Kirby bauer's disk diffusion

- o MHA = Muller Hinton Agar used



Antibiotics given

- If organism grows around it, it is antibiotic resistant
- If organism does not grow around it, it is antibiotic sensitive

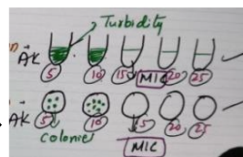
Disk Diffusion

MHA

b) Dilution method → Broth dilution →

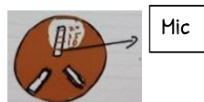
(Gold std)

(Antibiotic dilutions) Agar dilution →



c) Epsilon meter →

Test

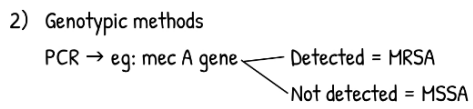
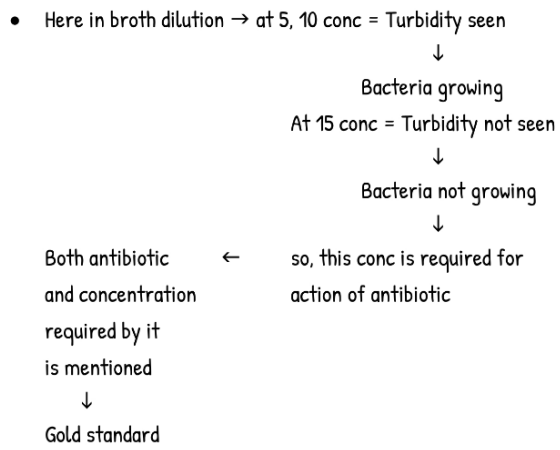


MHA

↓  
Strips used (Different antibiotic)

# General Microbiology

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## Bacteria - GPC & GNC

- GPC:
  - Staphylococcus
  - Streptococcus
  - Pneumococcus
  - Enterococcus

- GNC:
  - Meningococcus
  - Gonococcus

### GPC

01:20

- i) Staphylococcus:
- Virulence Factor:
  - a. Cell Surface Factor: Protein A → Antiphagocytic
  - b. Enzymes:
    - Coagulase
    - DNase
    - Hyaluronidase
    - Staphylokinase
  - c. Toxins:
    - Hemolysin →  $\beta$ -hemolysis
    - TSST-Type-1 → TSS
    - Enterotoxin → GE - Preformed, IP < 6 hours, heat stable, source: milk & milk products
    - Exfoliative → SSSS
- Clinical features:
  - Abscess, cellulitis, impetigo, botryomycosis
  - Native valve IE (MC) and nosocomial pneumonia
  - Osteomyelitis
- Diagnosis:
  - Micro → GPC clusters
  - Culture → BA -  $\beta$ -hemolysis  
NA - Golden Yellow Colonies (oil paint appearance)
  - Test: Catalase positive, coagulase positive

## ← Bacteria-GPC & GNC

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- MRSA:
  - SA resistant to all  $\beta$ -lactam antibiotics
  - SA (Transduction)  $\rightarrow$  MRSA  
Mec A gene  $\rightarrow$  [PBP  $\rightarrow$  PBP<sub>2a</sub>]
  - Disk Diffusion  $\rightarrow$  Cefoxitin disk  $\rightarrow$  S: SA; R: MRSA
  - PCR  $\rightarrow$  Mec A gene
  - DOC: Vancomycin
  - Other drugs: (VRSA)
    - Linezolid
    - Streptogramin
    - Daptomycin (Best)
    - 5<sup>th</sup> Gen Cephalosporins
  
- CONS (Coagulase Negative, Coagulase positive Staphylococcus):
  - Staphylococcus epidermidis:
    - Predisposing factor: Injury to skin
    - Stitch abscess (SSI)
    - Most common cause of Prosthetic valve IE (<12months of surgery)
  - Staphylococcus saprophyticus:
    - Female urethra  $\rightarrow$  Injury (sexually active)  $\rightarrow$  UTI
  
- ii) Streptococcus:
  - Virulence factors:
    - a) Cell surface factors: Protein M  $\rightarrow$  Antiphagocytic
    - b) Enzymes:
      - DNase (Streptodornase)  $\rightarrow$  A, B (mc), C, D
      - Hyaluronidase
      - Streptokinase
    - c) Toxins:
      - Hemolysin (Streptolysin)
        - Streptolysin S  $\rightarrow$   $\beta$ -hemolysis on BA
        - Streptolysin O  $\rightarrow$  ASO
      - TSST- Type-2 (Pyogenic exotoxin)  $\rightarrow$  TSS
  
- Clinical Features:
  - Group A streptococcus -
    1. Pharyngitis  $\rightarrow$  ARF  $\rightarrow$  ASO > 200IU/mL



## Bacteria-GPC & GNC

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2. Skin infection → PSGN → Anti-DNAse > 300IU/mL
- Group B Streptococcus:
- Neonatal meningitis (most common cause)
- Diagnosis:
- Micro: GPC chains
  - Culture: β-hemolysis
  - Tests:
    - Catalase negative
    - Bacitracin sensitive (Group A streptococcus)
    - CAMP test positive (Group B streptococcus)
- iii) Pneumococcus:
- Clinical features:
- Meningitis (MC)
  - Pneumonia (MC)
- Diagnosis:
- Micro → GPC - Pairs → Lens shape → Capsulated
  - Culture: α-hemolysis with carrom coin colonies
  - Tests:
    - Catalase negative
    - Optochin sensitive
    - Bile soluble
    - Inulin fermenter
- Vaccine:
- PPSV-23 → C/I in < 2 years
  - PCV-13 → Can be given < 2 years
- iv) Enterococcus:
- **2 common species:** Faecalis (most common infection) and fecium (most drug resistant)
  - **Clinical features:** UTI, wound infection, intra-abdominal infection
  - **Diagnosis:**
    - Micro → GPC in pairs - spectacle-shape, non-capsulated
    - Culture: No hemolysis



## Bacteria-GPC & GNC

Topic Notes: 4

- Test:
  - Catalase negative
  - Bile esculin test positive
  - PYR test positive

### GNC

31:40

- i) Meningococcus
  - Clinical features:
    - Meningitis with rashes
    - Waterhouse Friedrichsen Syndrome
  - Diagnosis:
    - Microbiology → GNC - pairs - lens shaped - capsulated
    - Culture → Thayer Martin medium
    - Tests → Maltose fermenters
  - Vaccine:
    - a. Capsulated → CI < 2 years
    - b. Conjugated → can be given in < 2 years
- ii) Gonococcus
  - Clinical features: → UTI
    - Males: Urethritis + Perianal abscess → Water-can perineum
    - Females: Vulvovaginitis + perihepatic inflammation → Fitz Hugh Curtis Syndrome
    - Neonates: Ophthalmia neonatorum
  - Diagnosis:
    - Micro: GNC → Pairs, kidney shaped, non-capsulated
    - Culture: Thayer Martin medium
    - Tests: Maltose non-fermenters

## Bacteria-GPB

### BACILLUS

00:20

- I. B. anthracis:
  - Virulence factor: Anthrax toxin
  - Clinical features:
    - Anthrax → Cattle
      - a. Cutaneous anthrax (Hide Porter's disease): Malignant pustule → Black eschar
      - b. pulmonary anthrax (Wool sorter's disease): Haemorrhagic pneumonia
      - c. intestinal anthrax: abdominal pain, diarrhea
  - Diagnosis:
    - Microscopy: Non-bulging spores → Bamboo stick appearance
    - Culture:
      - Solid media: medusa head appearance
      - Solid media + Penicillin: String of pearl appearance
      - Gelatin tube media: Inverted fir tree appearance
    - Test: Ascoli Thermo Precipitation Test
- II. B. cereus:
  - It causes gastroenteritis
  - It produces 2 toxins:
    - 1. Emetic toxin: Fried rice → Preformed → IP: 1-6 hours → Heat stable
    - 2. Diarrheal toxin: Canned meat and vegetables → Post formed → IP: 8-16 hours → Heat stable

### CLOSTRIDIUM

07:20

- I. Cl. Perfringens
  - Bulging spores
  - Virulence factor:  $\alpha$ -toxin
  - Clinical features:
    - Gas gangrene
    - Food poisoning
  - Diagnosis:
    - Microscopy: GPB with subterminal bulging spore
    - Culture: RCM (Anaerobic)

## Bacteria-GPB

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- Tests:
  - Naegler's reaction
  - Reverse CAMP test
  - Double zone hemolysis
  
- II. Clostridium tetani:
  - GPB with terminal bulging spore (Drum stick appearance)
  - Tetanospasmin: presynaptic inhibition of inhibitory NT (Glycine/GABA) → Spastic paralysis
  
- III. Clostridium botulinum:
  - Botulinum toxin: A, B, C<sub>1</sub>, D, E, F, G → Presynaptic inhibition of excitatory NT (Ach) → Flaccid paralysis
  - Toxin C<sub>2</sub>: Food poisoning
  
- IV. Clostridium difficile:
  - Commensal → Predisposing factors (long term use of 3<sup>rd</sup> generation cephalosporins, ampicillin, clindamycin) → Exotoxin A & B → Diarrhea & pseudomembranous colitis.
  - Drug of choice: Vancomycin + Metronidazole

### CORYNEBACTERIUM DIPHTHERIAE

16:16

- Virulence factor: Diphtheria toxin
  - Clinical features: Diphtheria
    - Faucial (pseudo-membrane)
    - Cutaneous
    - Systemic
  - Diagnosis:
    - Microscopy: GPC → Chinese letter pattern → Albert's stain - Metachromatic granules
    - Culture: Selective medium:
      - i. LSS: White colonies - <6 hours (less selective → After 6 hours, commensals grow)  
Metachromatic granules are best detected.
      - ii. PTBA: Black colonies
      - iii. Tinsdale: Black colonies with brown halo
- } 48 hours
- Tests: Elek's gel precipitation test

# Bacteria-GPB

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## MYCOBACTERIUM

21:30

- I. M. tuberculosis
  - Virulence factor:
    - LAM
    - Mycolic acid
  - Clinical features:
    - Pulmonary TB
    - Extrapulmonary TB
  - Diagnosis:
    - Microscopy:
      - Direct immunofluorescence (best)
      - ZN staining: Acid Fast
    - Culture:
      - Liquid: MGIT → Benefit: Half time for incubation as compared to solid media, AST for all drugs.
      - Solid: LJ media, Middlebrook 7H10/11 (best)
    - Tests:
      - CBNAAT: ID + AST for rifampicin
      - LPA: ID + AST for all drugs
      - Mantoux: Type IV hypersensitivity test
      - Rapid: MPT64 antigen detected
- II. M. Leprae
  - Ridley Jopling classified Leprosy into:
    - TT
    - BT
    - BB
    - BL
    - LL
  - WHO classified Leprosy into:
    - Tuberculoid (Paucibacillary):  $S \leq 5, N \leq 1$
    - Lepromatous (Multibacillary):  $S > 5, N > 1$
  - Clinical features: hypopigmented patches with thickened nerves.
  - Lepra reaction: Hypersensitivity reaction during course of treatment:
    1. Type I:
      - Type IV hypersensitivity
      - At BB stage
      - Th<sub>1</sub> CD4 response
      - Inflammation of existing lesions or new lesions

## ← Bacteria-GPB

Topic Notes: 5

- Treatment: Glucocorticoids

### 2. Type II:

- Type III hypersensitivity
- At LL stage
- Th<sub>2</sub> CD4 response
- Crops of nodular lesions (ENL)
- Treatment: Glucocorticoid or Thalidomide

### III. Atypical Mycobacterium:

Runyon Classification			
Slow Growers			Rapid Growers
Photochromogen	Scotochromogen	Non-chromogen	
M. kansasii	M. scrofulaceum (LN)	MAC (MC)	M. Fortuitum
M. marinum (cut) Swimming pool granuloma	M. Szulgai	M. ulcerans (cut) → Buruli ulcer by Mycolactone toxin	M. chelonae abscessus

- Clinical features:
  - Lymph node infection
  - Cutaneous infection
  - Pulmonary infection

## ACTINOMYCES

40:05

- Clinical features: Actinomycosis (lumpy jaw) → Discharging granules at angle of jaw → Yellow (Sulphur)
- Diagnosis:
  - Microscopy: Sunray appearance
  - Culture: Thioglycolate broth (Fluffy balls at the bottom of the tube)

## NOCARDIA

42:22

- Clinical features:
  - Nocardiosis – Pulmonary nocardiosis > brain abscess
  - Actinomycetoma (MC): White-yellow discharging granules from the foot

← **Bacteria-GPB**  
Topic Notes: 5

- Diagnosis:
  - Microscopy: Sunray appearance
  - Culture: Paraffin bait technique

**LISTERIA**

45:09

- Clinical features:
  - Listeriosis: Food poisoning (refrigerated food)
  - Neonatal meningitis
- Diagnosis:
  - Microscopy:
    - GPB
    - Differential motility (Tumbling)
  - Culture: PALCAM agar

## Bacteria - GNB

### Enterobacterales

#### I. Escherichia coli:

- EPEC: Non-toxicogenic → Diarrhea → Children
- ETEC: Labile toxin & stable toxin → Diarrhea → Travellers
- EAEC: EAST-1 toxin → Diarrhea → Travellers
- EIEC: VMA → Dysentery
- EHEC (O157:H7): Verocytotoxin → dysentery and HUS
- UPEC → Fimbria → UTI

#### II. Klebsiella:

1. Klebsiella pneumoniae: pneumonia, meningitis, UTI, wound infection
2. K. granulomatis: granuloma inguinale → painless red beefy genital ulcer that bleeds on touch with pseudo-bubos.

#### III. Salmonella:

- Clinical features: Typhoid fever -
  - S. typhi
  - S. paratyphi A
  - S. paratyphi B
- Carriers:
  - Stool carriers
  - Urine carriers
- Diagnosis:
  - Culture: Wilson Blair  
XLD, DCA, SSA
  - Tests: Widal test
  - Carriers:
    - Vi Ab test: Screening
    - Stool/Urine culture: Confirmatory
    - Sewer Swab Method: Community

#### IV. Shigella:

- Group A: Sh. Dysentriae
- Group B: Sh. Flexneri
- Group C: Sh. Boydii

## ← Bacteria-GNB

Topic Notes: 8

- Group D: Sh. Sonnei (LLF)
  - Clinical features:
    - VMA & Enterotoxin: Dysentery
    - Shiga toxin: HUS
  - Diagnosis: culture → XLD, DCA, SSA
- V. Proteus:
- Clinical features: UTI → phosphate stones (urease), wound infection
  - Diagnosis:
    - PPA test → PAD enzyme
    - Diene's phenomenon (strains)
- VI. Yersinia:
1. Yersinia pestis:
    - Non-motile
    - Rat flea (*Xenopsylla cheopis*)
    - Plague: Bubonic, Pneumonic, Septicaemic
  2. Yersinia enterocolitica
    - Differential motility
    - Feco-oral
    - Gastroenteritis
  3. Yersinia pseudotuberculosis
    - Differential motility
    - Feco-oral
    - Izumi fever
- Diagnosis:
    - Microscopy: Bipolar staining → Safety pin appearance
    - Culture: Ghee broth → Stalactite growth

### VIBRIO

19:15

- Non-halophilic (NaCl 0.5-1%)
  - *V. cholerae* → *Vibrio cholerae* 01, *Vibrio cholerae* 0139
- *Vibrio cholerae*:
  - VF: Cholera toxin - increases cAMP
  - Clinical features: Cholera

## Bacteria-GNB

Topic Notes: 8

- Diagnosis:
  - Microscopy: Comma shaped with fish in stream appearance
  - Culture: TCBS → Yellow colonies
  - Tests: String test positive, Cholera red reaction positive
- Halophilic vibrios:
  1. *V. parahaemolyticus*
    - Virulence factor: Capsule
    - Clinical features: GE, wound infection
    - Diagnosis:
      - Microbiology: Bipolar staining → Safety pin appearance
      - Culture:
        - TCBS → Green colonies
        - Wagatsuma agar → Kanagawa phenomenon

### PSEUDOMONAS

25:41

- Virulence factor: Exotoxin A
- Clinical features:
  - Swimmer's ear → Children
  - Malignant otitis externa → Diabetes
  - MC infection in burns and cystic fibrosis patient
- Diagnosis: Culture → Cefrimide agar

### BURKHOLDERIA

27:25

1. *B. pseudomallei*
  - Safety pin appearance
  - Motile
  - Oxidase positive
  - Causes melioidosis
2. *B. mallei*:
  - Non-motile
  - Oxidase negative
  - Glander's disease



## Bacteria-GNB

Topic Notes: 8

3. *B. cepaciae*
  - Motile
  - Oxidase positive
  - Nosocomial pneumonia

### CAMPYLOBACTER & HELICOBACTER

29:45

- Campylobacter:
  - Clinical features: diarrhea
  - Diagnosis:
    - Microscopy: 'S' shape
    - Culture: Skirrow's medium
- Helicobacter:
  - Clinical features: diarrhea, PUD, Gastric Ca
  - Diagnosis:
    - Microscopy: Comma shaped
    - Culture: Skirrow's medium
    - Test: Urease positive

### HEMOPHILUS

31:42

1. *H. influenzae b*
  - Clinical features:
    - Pneumonia
    - Meningitis
    - Epiglottitis
  - Diagnosis:
    - Microscopy: GNGB
    - Culture:
      - Fildes' digest agar
      - BA → Satellitism
2. *H. Ducrei*
  - Chancroid (soft chancre)
  - Painful genital ulcer which bleeds on touch with bubos
  - Safety pin appearance on bipolar staining

## ← Bacteria-GNB

Topic Notes: 8

### BORDETELLA

34:38

- Clinical features: Whooping cough
- Diagnosis:
  - Microscopy: Thumb print appearance
  - Culture: Bordet Gengue medium:
    - Bisected pearl colonies
    - Aluminium paint appearance

### BRUCELLA

35:49

- Clinical features: Brucellosis (cattle) → RES, MS & ...
- Diagnosis:
  - Microscopy: GNCB
  - Culture: Trypticase soy agar
  - Test: SAT

### SPIROCHAETES

37:29

- I. Treponema pallidum
- **Clinical features:** Syphilis -
    - Primary: Hard chancre → Painless with bubos
    - Secondary: Papules → Condyloma lata
    - Latest: Asymptomatic → Serology positive
    - Tertiary: Gumma → Skin, CNS, CVS
  - **Congenital syphilis:**
    - Early: Skin, joint, RES
    - Late:
      - Hutchinson's triad:
        - i. Interstitial keratitis
        - ii. SNHL
        - iii. Hutchinson's teeth
  - **Diagnosis:**
    - Microscopy:
      - Dark field microscopy:
        - Motility: Flexion extension type

**Bacteria-GNB**

Topic Notes: 8

- Silver impregnation staining (Fontana): brown-colored bacteria with golden background
- Culture: Rabbit testes
- Tests:
  - a. Non-treponemal test: Screening test
    - i. VDRL
    - ii. RPR
  - b. Treponemal:
    - i. FTA-ABS (Gold standard)
    - ii. TPHA
- II. **Borrelia:**
  - *B. burgdorferi*: Lyme's disease → Ixodes tick
  - *B. recurrentis*: Relapsing fever → Louse
  - *B. vincenti*: Vincent's angina → Commensal → Injury to oral cavity
  - Diagnosis: Culture – Modified Kelly's medium
- III. **Leptospira:**
  - Clinical features: Leptospirosis (Rat's urine) → RES, Renal
  - Diagnosis:
    - Culture: EMJH
    - Test: MAT

**RICKETTSIA**

48:51

- It can manifest with Black eschar and it causes endothelial injury.
- It is not cultivable → Tissue culture
- Typhus group:
  - a) Epidemic typhus:
    - *R. prowazekii* → Louse
    - OX19 positive
  - b) Endemic typhus:
    - *R. typhi* → Flea
    - OX19 positive



## Bacteria-GNB

Topic Notes: 8

- Spotted fever group:
  - a) Rocky mountain spotted fever:
    - R. Rickettsiae → Tick
    - OX19, OX2 positive
  - b) Indian tick typhus:
    - R. conorii → Tick
    - OX19, OX2 positive
  - c) Rickettsial pox:
    - R. akari → mite
    - Negative for OX19, OX2 & OXK
  
- Rickettsia related disease:
  - a) Scrub typhus:
    - Orientia Tsutsugumushi
    - Trombiculid mite larva
    - OXK positive
  - b) Trench fever:
    - Bartonella quintana
    - Louse
    - Negative for OX19, OX2 & OXK
  - c) Q fever:
    - Coxiella burnetii
    - Inhalation transmission
    - Negative for OX19, OX2 and OXK

## CHLAMYDIA

57:29

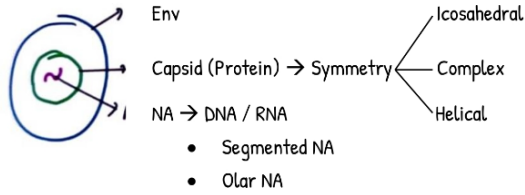
1. Chl. Trachomatis TRIC
    - A, B, C: Trachoma
    - D-K: Inclusion conjunctivitis, NGU
  2. Chl. Trachomatis LGV → L1, L2, L3 → LGV - Painless genital ulcer with bubos
  3. Chl. Psittaci: Psittacosis
  4. Chl. Pneumoniae: atypical pneumonia
- **Diagnosis:** tissue culture

## MYCOPLASMA & LEGIONELLA

59:44

- Mycoplasma:
  - Clinical features: atypical pneumonia, NGU
  - Diagnosis:
    - Microscopy: Diene's method
    - Culture: PPLO – Fried egg colonies
  
- Legionella:
  - Clinical features:
    - Atypical pneumonia
    - Pontiac fever
    - Myocarditis
  - Diagnosis:
    - Culture – BCYE agar
    - Test: Rapid urine test

# General Virology



DNA env (HHP)	DNA non-env (PAP)	RNA env (RFT & others)	RNA non-env (PCR)
Hepadna (HBV)	Papova (HPV)	Retro (HIV)	Picorna (Enteroviruses) Polio, Coxsackies, HAV
Herpes (Herpes [8])	Adenovirus	Flavivirus (HCV, KFD, JE, Dengue, YF, Zika)	Calci (HEV)
Pox (Pox) (Largest)	Parvo (ss DNA) (Parvo) (Smallest)	Toga (Chikungunya, Rubella)	Reo [ds] (Rota)
		Others: <ul style="list-style-type: none"> <li>Arena (Lassa fever)</li> <li>Bunya (Hanta, CCF)</li> <li>Orthomyxovirus (Influenza)</li> <li>Paramyxovirus (Parainfluenza, RSV, Mumps, Measles, Nipah)</li> <li>Rhabdo (Rabies)</li> <li>Filo (Ebola, Marburg)</li> <li>Delta (HDV)</li> <li>Corona (Corona)</li> </ul>	

- Symmetry:
  - Icosahedral: Hepadna, Herpes, Papova, Adeno, Parvo, Retro, Flavi, Toga, Picorna, Calci, Reo
  - Complex: Pox

## General Virology

Topic Notes: 3

- Helical: Others → Arena, Bunya, Orthomyxo, Paramyxo, Rhabdo, Filo, Corona, Delta
- Segmented NA: Rota (11), Influenza (8), Bunya (3), Arena (2)
- Circular NA: Arena, Bunya, Delta, HBV, HPV

### INCLUSION BODIES

13:47

- Precipitation of viral components inside cell during replication.
- Intranuclear:
  - a. Cowdry type A:
    - i. Torres: YF
    - ii. Lipschultz: HSV
    - iii. Owl eye appearance: CMV
  - b. Cowdry type B: Adeno, Polio
- Intracytoplasmic:
  - a. Rabies: Negri
  - b. Pox:
    - Small pox: Paschen
    - Vaccinia: Guaneri
    - MC: HP
    - Fowl pox: Bollinger
- Both intranuclear and intracytoplasmic: Measles – Warthin Finkeldey bodies

### VIRUS CULTIVATION

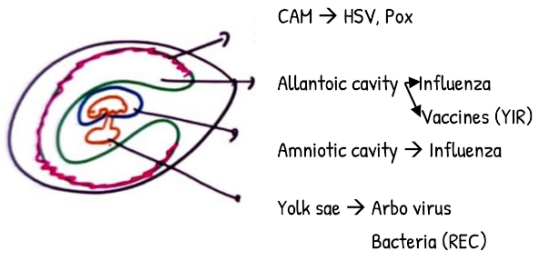
18:22

1. Animal inoculation:
  - Mice:
    - Cerebrum: Rabies, Coxsackie
    - Foot pad: M. leprae
  - Rabbit: Tests – T. pallidum

## General Virology

Topic Notes: 3

### 2. Embryonated Egg Culture:



### 3. Tissue culture/cell culture:

- a. Primary cell culture:
  - Chick embryo fibroblast
  - Rhesus monkey kidney
- b. Diploid cell line
  - Human diploid lung fibroblast (WI-38 and MRC-5)
- c. Continuous cell line
  - HeLa, Hep-2, McCoy, BHK, Vero (most commonly used)

### VIRUS ASSAY

27:13

- i. Pock assay: CAM → HSV, Pox
- ii. Plaque assay: Tissue culture → All viruses

### VACCINES

28:55

- Live:
    - BCG, OPV, Rota, MMR
    - Small pox, Chicken pox, Typhoid, Cholera
    - JE, Dengue, YF, Influenza
- Contraindicated in immunocompromised patients.

## Virology-DNA Viruses

Topic Notes: 4

# Virology - DNA Viruses

## HEPATITIS VIRUSES

00:30

- I. HAV (RNA)
  - Cultivable
  - Feco-oral
  - Acute hepatitis
  - IgM ELISA
  - Treatment is symptomatic
  - Vaccine → Killed
  
- II. HBV (DNA)
  - Non-cultivable
  - Parenteral, sexual, vertical
  - Acute and chronic hepatitis
  - IgM ELISA
    - HBsAg: Infective                      Anti-HBs: Recovery and vaccination
    - HBcAg: Not detectable              Anti-HBc: Recovery (Appear early)
    - HBeAg: High infectivity              Anti-HBe: Recovery. Low infectivity
  - Treatment: IFN- $\alpha$  + Lamivudine
  - Vaccine: Subunit (HBsAg)
  
- III. HCV (RNA):
  - Non-cultivable
  - Parenteral, sexual, vertical
  - Acute and chronic hepatitis
  - PCR
  - Treatment: INF- $\alpha$  + Ribavirin; Direct Acting Anti-viral → DOC
  
- IV. HDV (RNA)
  - Non-cultivable
  - Transmitted by parenteral, sexual, vertical
  - Acute and chronic hepatitis
  - Co-infection:
    - HDV: IgM
    - HBV: IgM
  - Super-infection:
    - HDV: IgM
    - HBV: IgG
  - Diagnosis: IgM ELISA

## Virology-DNA Viruses

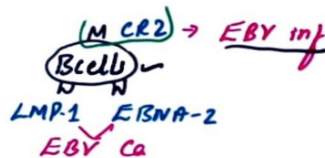
Topic Notes: 4

- Treatment: Treat HBV

- V. HEV (RNA)
- Non-cultivable
  - Feco-oral
  - Acute hepatitis (increased mortality in pregnancy)
  - IgM ELISA

### HERPES (18 28)

- Vesicles are characteristically present.
- I. Herpes-1: HSV-1
    - Mollaret's meningitis
    - Sporadic encephalitis (Temporal lobe)
    - Multinucleated Giant Cells → Tzank smear
  - II. Herpes-2: HSV-2
    - Genital herpes
    - Neonatal herpes
  - III. Herpes 3: VZV
    - Primary infection: Chicken pox
    - Reactivation: Herpes zoster
    - Congenital (fetal) Cicatrisation, Limb hypoplasia
    - MNG on Tzank smear
  - IV. Herpes 4: EBV
    - Infectious Mononucleosis: Pharyngitis
    - Ca: Gastric, Nasopharyngeal
    - Lymphoma: Burkitt's and Hodgkin's



- Paul Bunnell test positive (screening)
- Monospot test positive (confirmatory)

## ← Virology-DNA Viruses

Topic Notes: 4

- V. Herpes-5: CMV
  - Infectious Mononucleosis: Pharyngitis negative
  - Congenital: MC of all congenital infection
  - Post-transplant: Most common of all post-transplant infection
- VI. Herpes-6: HBLV
  - 6<sup>th</sup> disease: Roseola infantum
  - Encephalitis
- VII. Herpes-7: RK
  - Encephalitis
- VIII. Herpes-8: KS
  - Kaposi Sarcoma

### POX VIRUSES

30:54

- I. Small pox: Small pox → Irradicated → Cow pox vaccine → Edward Jenner
- II. Vaccinia V: Vaccinia
- III. Molluscum Contagiosum Virus: Molluscum Contagiosum

### HPV

32:45

- I. HPV 6, 11: anogenital warts
- II. HPV 16, 18, 31, 33, 45, 52, 58 → Cervical cancer
- Vaccines: Subunit (L<sub>1</sub> Ag)
  - Cervarix: HPV 16, 18
  - Gardasil: HPV 6, 11, 16, 18
  - Gardasil-9: HPV 6, 11, 16, 18, 31, 33, 45, 52, 58

### ADENOVIRUS

36:50

- It commonly causes respiratory tract infection
- Serotypes:
  - Adeno 3, 7: Acute follicular conjunctivitis
  - Adeno 11, 21: Haemorrhagic cystitis
  - Adeno 40, 41: Gastroenteritis



## Virology-DNA Viruses

Topic Notes: 4

### PARVOVIRUS

38:25

- Parvovirus B19 is the only parvovirus which can cause human infection:
  - Child: 5<sup>th</sup> disease (Slapped cheek appearance)
  - Adult: arthritis, arthralgia
  - Immunocompromised: Aplastic anemia, sickle cell anemia
  - Congenital: Abortion, non-immune fetal hydrops

# Virology - RNA Viruses

## HIV

0:15

- Clinical presentation: 4 stages by WHO
  - Stage 1:
    - Asymptomatic
    - Generalised Lymphadenopathy
  - Stage 2:
    - Superficial fungal infection
    - Herpes zoster
  - Stage 3:
    - Oral candidiasis
    - Oral hairy leukoplakia
    - Pulmonary TB
    - Fever >1 month
    - Diarrhea >1 month
    - Weight loss >10%
  - Stage 4:
    - Oesophageal candidiasis
    - Extra-pulmonary TB
    - Wasting syndrome
    - Kaposi sarcoma
    - Opportunistic infections
- Diagnosis:
  - Antibody tests: 3 different rapid test -
    - Strategy 2B: Symptomatic → 2 positive
    - Strategy 3: Asymptomatic → All 3 positive
  - Direct tests:
    - RNA PCR
    - P24 Ag assay
  - Window period: Direct tests - RNA PCR
  - Infants: Direct tests - DNA PCR
- Treatment:
  - HIV 1:
    - 1<sup>st</sup> Line: L (Lamivudine) E (Efavirenz) T (Tenofovir)
    - 2<sup>nd</sup> Line: L (Lamivudine) L (Lopinavir) T (Tenofovir)
  - HIV 2: L (Lamivudine) L (Lopinavir) T (Tenofovir)
  - PEP: L (Lamivudine) L (Lopinavir) T (Tenofovir)

## FLAVIVIRIDAE

12:57

- I. Kyasanur Forest Disease Virus:
  - Rat (reservoir) → Monkey (amplifier) → Ixodes Tick → Humans → Haemorrhagic fever
  - Vaccine (Killed)
  
- II. Japanese Encephalitis:
  - Herons & Ducks (reservoirs) → Pig (amplifiers) → Culex → Humans → Encephalitis (UP) [age 5-15 years]
  - Vaccine:
    - Live: SA-14-14-2
    - Killed: Nakayama & Beijing
  
- III. Dengue (5 serotypes):
  - Aedes → Humans → Classical dengue fever (haemorrhagic fever & retroorbital headache) → DHF, DSS (reinfection with other serotypes → Antibody Dependent Enhancement)
  - Vaccine: Live (CYD-TDV)
  
- IV. Yellow Fever Virus: Not reported in India
  - Aedes → Humans → Haemorrhagic fever and hepatitis
  - Vaccine:
    - Live: 17-D
    - Killed: Dakar
  
- V. Zika virus:
  - Aedes/Sexual → Humans → GBS
  - Congenital → Microcephaly
  
- VI. HCV:
  - Not an arbovirus

## TOGAVIRIDAE

26:44

- I. Chikungunya virus:
  - E1-226A  $\xrightarrow{\text{Mutation}}$  E1:226V
  - Aedes → Humans → Arthritis

- II. Rubella Virus:
  - Clinical presentation: Adults → Forchheimer spots → Soft palate
  - Congenital:
    - Congenital Rubella Syndrome:
      - Salt & pepper retinopathy, cataract
      - SNHL
      - PDA
    - BMS: Petechial spots
  - Vaccine: RA 27/3

## PICORNAVIRIDAE

32:41

- Rhinoviruses: Inhalational route
- Enteroviruses: Feco-oral
- Enteroviruses:
  - a. Polio virus:
    - Serotypes:
      - Type 1: most common, associated with paralysis
      - Type 2: VDPV
      - Type 3: VAPP
    - Clinical features: Polio disease
      - Meningitis: 1%
      - Flaccid paralysis: < 1%
    - Vaccine: Type 1 & 3
      - Live: Sabin (OPV)
      - Killed: Salk (IPV)
  - b. Coxsackie Virus:
    - Coxsackie A: Herpangina & HFMD
    - Coxsackie A-24 serotype: Acute haemorrhagic conjunctivitis
    - Coxsackie B: Myocarditis
  - c. Enterovirus:
    - Enterovirus 71: Herpangina & HFMD
    - Enterovirus 70: Acute haemorrhagic conjunctivitis
  - d. HAV: Acute hepatitis
    - Earlier: Enterovirus 72

## CALCIVIRIDAE

42:52

- HEV: Acute hepatitis
- Noro & Sappo: Gastroenteritis

## REOVIRUS

43:53

- Rota G1P[8]:
  - GE in children → Intussusception
  - Vaccine: Live [oral]

## OTHER VIRUSES

45:00

- I. Arenavirus:
  - Lassa fever virus (not reported in India)
  - Rat (reservoir) → Humans → haemorrhagic fever and pneumonia
  
- II. Bunyavirus:
  - a. Hantavirus (Not reported in India)
    - Rat (reservoir) → Humans → Haemorrhagic fever and pneumonia
  - b. CCF virus (Crimean Congo Fever Virus):
    - Ixodes Tick (Vector) → Humans → haemorrhagic fever
  
- III. Orthomyxovirus:
  - a. Influenza virus:
    - Serotypes:
      - Influenza A:
        - Sub-serotypes:
          - H1N1: Swine flu/Pandemic flu
          - H3N2: Seasonal flu
          - H5N1: Avian flu
        - Clinical features: Pneumonia
        - Pandemics and epidemics (caused by antigenic variation)
      - Influenza B:
        - Clinical features: Pneumonia associated with diarrhea
        - Epidemics
    - Antigenic variation:
      - Antigenic shift: Genetic reassortment → Pandemics
      - Antigenic drift: Point mutation → Epidemics

- Treatment: NA inhibitors -
  - Oseltamivir
  - Zanamivir
- Vaccine:
  - Live (Inhalation)
  - Killed (IM)

IV. Paramyxoviruses:

- a. Parainfluenza: Laryngotracheobronchitis
- b. RSV: Bronchiolitis in children
- c. Mumps:
  - Salivary gland swelling
  - Meningitis
  - Gonaditis
- d. Measles:
  - Complications:
    - Most common: Otitis media
    - Late: SSPE
      - 7-10 years
      - 4-10/1 lakh
      - Progressive mental deterioration with myoclonus
      - IgG measles in CSF
    - Immunocompromised: Hetch's pneumonia
- e. Nipah:
  - Fruit bat (reservoir) → Humans → Encephalitis
  - Outbreaks in India:
    - West Bengal: 2007 and 2011
    - Kerala: 2018

**RHABDOVIRUS**

01:01:26

- Rabies virus is a bullet shaped virus
- Animal bite:
  - Dog: India
  - Bat: World
- Animal bite → Spread via nerves → Brain stem encephalitis → Prophylaxis

- Local:
  - Wash wound → Running tap water → 15 minutes
  - Antisepsis
  - Ig → Surrounding wound
- Systemic:
  - IgG: IM
  - Vaccines: Regimens -

PEP	0	3	7	14-28
IM (Essen)	1	1	1	1
ID (Red-cross)	2	2	2	-
IM (Zagreb)	2	-	1	1

PreP	0	7
IM	1	1
ID	1	1

PEP in PreP	0	3
IM	1	1
ID	2	2
ID	4	-

## FILOVIRIDAE

01:12:40

- Long filamentous virus:
- Ebola virus and Marburg virus (Not reported in India)
- Fruit bat (reservoir) → Humans → haemorrhagic fever

## DELTAVIRIDAE

01:13:58

- HDV:
  - Acute and Chronic hepatitis
  - Co-infection and superinfection

## CORONA

01:14:20

- Coronavirus:
- Pandemic:
  - SARS-CoV → 2003 → China → Bat
  - MERS-CoV → 2012 → Saudi Arabia → Camel
  - SARS-CoV-2 → 2019 → China → Bat
- Clinical features: Fever, sorethroat, cough, diarrhea, myalgia → Pneumonia → multi-organ failure [Cytokine storm] (IL-6)
- Diagnosis: Nasopharyngeal swab or/and Oropharyngeal swab →
  - Direct test:
    - PCR
    - Rapid Ag detection
  - Treatment: Corticosteroids & IL-6 inhibitors:
    - Tocilizumab
    - Sarilumab
  - Vaccine:
    - Killed: Covaxin
    - Subunit or recombinant ('S' Ag): Covishield/Sputnik

# Parasitology - Protozoa

Protozoa:

Unicellular

Trophozoite → cyst (infective form)

- 1) Free living (Soil & water) (Trophozoite → cyst)
- 2) Intestinal (Trophozoite → cyst)
- 3) Vaginal (Trophozoite)
- 4) Blood & Tissue (different Morphological forms)

## FREE LIVING PROTOZOA: (AMOEBA)

2:00

(Soil & Water)

a) Naegleria Fowleri

C/f → PAM (acute)

Diagnosis → CSF mount



Rx → Amphotericin - B.

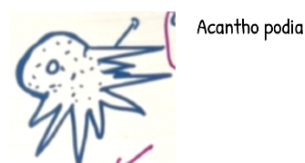
b) Acanthamoeba

C/f → GAE (chronic)

Contact lens keratitis.

Diagnosis → CSF mount

Δ<sup>sis</sup> → CSF mount



Only Trophozoite

2 walls → outer - irregular  
Inner → Polyhedral



Cysts are not seen

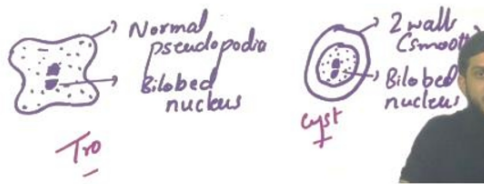
No treatment available

# Parasitology - Protozoa

Topic Notes: 8

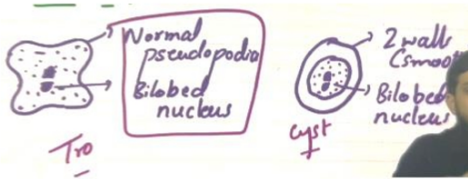
c) Balamuthia  
 C/f: → GAE (Chronic)  
 Diagnosis - CSF mount

Δ<sup>sis</sup> → CSF mount



d) Sappinia  
 C/f - encephalitis  
 Diagnosis - CSF mount

Δ<sup>sis</sup> → CSF mount



→ very rare

## INTESTINAL PROTOZOA

10:45

- Ciliates (cilia) → Balantidium Coli
- Amoeba (pseudopodia) → Entamoeba histolytica
- Flagellates (Flagella) → Giardia Lambia
- Sporozoa (Sporozoites) →
  - Cryptosporidium
  - Cyclospora
  - Isospora

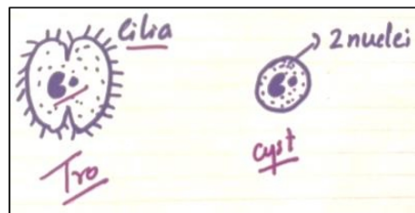
# Parasitology - Protozoa

Topic Notes: 8

Balantidium Coli: (Large intestine)

C/f: Dysentery

Diagnosis: Stool mount



Entamoeba histolytica (L.1)

C/p → amoebiasis

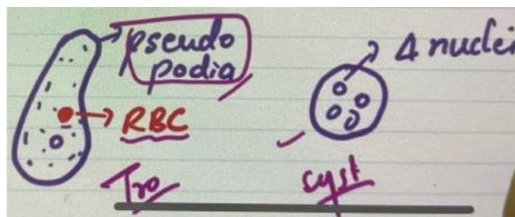
- Non - invasive intestinal → Asymptomatic (Cyst carrier)
- Invasive intestinal → Flask shape ulcer dysentery
- Extra intestinal → Abscessus (Liver Lung)

Diagnosis:

- Non invasive intestinal → Stool mount
- Invasive intestinal → Stool mount, ELISA
- Extra intestinal → Imaging (USG / CT) + ELISA

Stool:

Stool ex →



Rx

- Non - invasive int (Cyst carriers) → • Paramomycin • Iodoquinol • Diloxauid
- Invasive int → Metronidazole

# Parasitology - Protozoa

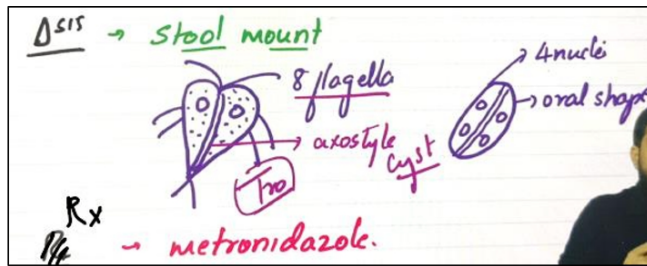
Topic Notes: 8

- Extra int → Surgery  
+  
Metronidazole

Giardia Lambia: (S.I)

C/f: Asymptomatic, Diarrhoea, Malabsorption

Diagnosis: Stool mount



Cryptosporidium & Cyclospora & Isospora:

C/f: diarrhoea (immunocompromised)

Diagnosis:

$\Delta$ sis → Stool mount	Acid fast staining
<p>Round shape 4-5 μm size 4 sporozoites</p>	
<p>Round shape 8-10 μm size 2 sporocyst 2 sporozoites In each sporocyst</p>	
<p>Oval shape 25-30 μm size 2 sporocysts 4 sporozoites in each sporocyst</p>	

# Parasitology – Protozoa

Topic Notes: 8

## VAGINAL PROTOZOA

31:06

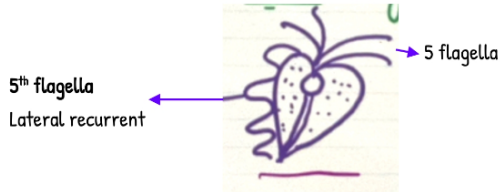
Flagellate

Trichomonas vaginalis

C/f: Vaginitis → Itching, thin, yellowish green discharge.

(Strawberry vagina)

Diagnosis: Urine / Vaginal mount discharge.



Rx: Metronidazole.

## BLOOD & TISSUE PROTOZOA

37:56

1) Flagellates

- a) Leishmania
- b) Trypanosoma

2) Sporozoa

- a) Plasmodium
- b) Babesia
- c) Toxoplasma

Leishmania:

Morphological forms:

- Morphological forms

A mastigote →



Promastigote →



Vector:

Sandfly (Phlebotomous argentepes)

# Parasitology - Protozoa

Topic Notes: 8

C/f:

- C/p → Leishmaniasis
  - Cutaneous L → L. Tropica (Oriental sore)
  - Muco cut. L → L. braziliensis (Espundia)
  - Visceral L → L. donovani (Kala azar)

Diagnosis:

PBS → Amastigote (LD body) within macrophage


Test → Napier's aldehyde Test (detect ↑<sup>ed</sup> IgG)  
Rapid test detects (rk39 Ag)

Rx → Amp - B

b) Trypanozoma:

1) Tryp. Cruzi

→ Morphological form

Trypomastigote → 

→ Vector → Reduvig bug

→ C/p → Chagas ds



Romana's sign

Diagnosis: PBS → Trypo. mastigote

Rx: Benznidazole.

2) Tryp. Bruci

• Morph forms →



Trypomastigote

• Vector → Tse Tse fly




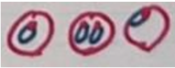

← **Parasitology – Protozoa**  
Topic Notes: 8

- C/p → Sleeping sickness  
↓  
Winter bottom sign
- $\Delta^{sis}$  → PBS → Trypomastigote
- Rx → Suramin

**BLOOD AND TISSUE PROTOZOA**

50:37

a) Plasmodiums (5 species)

- Morph form Liver, RBC  
Sporozoite → Trophozoite → Schizont → Gametocyte
  - Vector Female Anopheles Mosquito
  - C/p Malaria
  - $\Delta^{sis}$  → PBS → Trophozoite Schizont Gametocyte
- |                 |   |   |   |
|-----------------|---|---|---|
| P. Vivax →      |  |  |  |
| P. falciparum → |  | -   |  |

- Rapid test  
Plasmodium → PLDH Ag +ve  
P. falciparum → HRP - 2 Ag +ve
- Rx  
P. vivax → Quinine  
P. falciparum → Artemisinin compounds

**Babesia**

- Morph forms → Sporozoite → Trophozoite → Gametocyte
- Vector → Ixodes Tick
- C/p → Babesiosis
- $\Delta^{sis}$  → PBS → Gametocyte



- Rx. → Atovaquone

# Parasitology - Protozoa

Topic Notes: 8

Toxoplasma

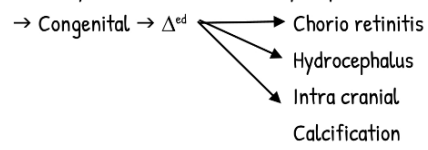
Morph forms

Sporozoites                      bradyzoi

Sporulated Oocyst → Tachyzoites → Tissue cyst

Transmission → feco - oral route

C/p → Toxoplasmosis → Cervical LNpathy



$\Delta^{sis}$  → PBS → Tachyzoite

Rx: Pyrimethamine + Sulfadiazine

Spiramycin (pregnant Women)

## Parasitology – Helminths

Topic Notes: 6

# Parasitology - Helminths

Worms → Egg → Larvae

Helminths → Worms → Egg → Larva

→ Cestodes → Tr. Soliuse (Pork)  
 (Tape. Worms) T. Saginata (Beef)  
 E. Granulosa (Dog)  
 H. Nana (Dwarf)  
 D. Latuns (Fish)

→ Trematodes → Schistosoma (Blood)  
 (Flukes) P. Westermani (lung)  
 F. hepatica (Liver)  
 F. buski (Int)

→ Nematode → Parthenogenic → S. stercoralis  
 (Cylindrical worms) worm  
 → Hook worm → A. duodenale  
 N. Americanus  
 → Round worm → A. Lumbricoides  
 → Pin / thread worm → E. vermicularis  
 → Whip worm → T. Trichura  
 → Filarial worm → W. Bancrofti  
 B. malayi  
 O. Vulvulus  
 Loa Loa  
 → Spiral worm → T. spiralis  
 → Guinea worm → D. medinensis

### T. SOLIUM

4:00

Inf form → Larva → Man → intestinal taeniasis  
 (definitive host)

Egg → Pig → Cysticercosis  
 (or)  
 Man

(Intermediate host) → Autoinfection

# Parasitology – Helminths

Topic Notes: 6

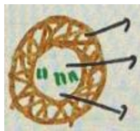
Cysticercosis → Neuro, ocular, s/c, m/s.  
 ↓  
 Parenchymal subarachnoid, meningeal gland.  
 ↓  
 Asymptomatic (m.c)  
 ↓  
 Seizures

### Diagnosis:

MRI → multiple small cyst with scolex inside

Rx → steroids + Albendazole

$\Delta^{sis}$  → Stool ex.



Embryophore  
 Embryo  
 3 pairs of hooklets

Egg

### T. Saginata (Beef Tapeworm)

Inf form → Larva → man → intestinal taeniasis (def. host)

→ Egg → Cattle → Cysticercosis (int. host)

$\Delta^{sis}$  → stool ex.

Acid fast staining



Egg



Acid fast

### E. Granulosus [Dog Tape worm]

(def host)

Inf form → Egg → man → Echinococcosis

(int.host) Liver (M.c)

Lung

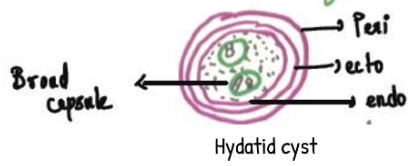
Brain

# Parasitology - Helminths

Topic Notes: 6

Diagnosis:

→ Fluid ex from tissue cyst post surgery



H. Nana [Dwarf Tape worm]

Inf. Form. → Egg → (man) → hymenolepiasis  
(only host) → autoinfection

Diagnosis: → Stool ex -

Polar filaments



Cyclops → 1<sup>st</sup> int. host

D. Latum [Fish Tape worm]

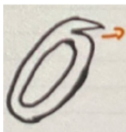
↓

2<sup>nd</sup> int. host.

Inf. Forms → Larva → Man → Diphyllbotriasis  
(def host)

→ megaloblastic anemia

Δ<sup>sis</sup> → Stool ex



operculum

**S. hematobilum**

Larva (cercaria)

↓

Skin penet

↓

Bladder plexus

↓

**S mansoni**

Larva (cercaria)

↓

Skin penet

↓

Inf. Mesenteric vein

↓

**S. japonicus**

Larva (cercaria)

↓

Skin penet

↓

Sup. Mesenteric vein

↓

# Parasitology – Helminths

Topic Notes: 6



Terminal spine



Urine sample



- Urinary schistosomiasis
- Bladder Ca



Lateral spine



Stool sample



- Katayama fever



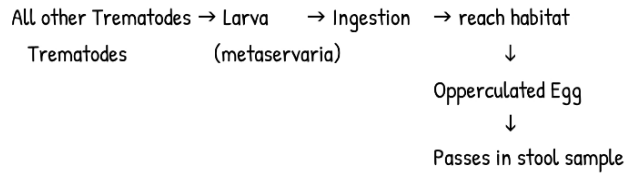
Lateral knob



Stool sample

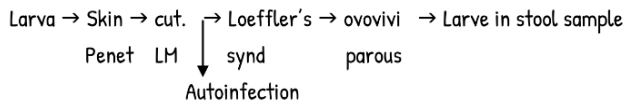


- Katayama fever
- Colon Ca



## Nematodes:

1) *S. Stercoralis* [Immunocompromised]



2) *A. duodenale* → old world HW

*N. Americanus* → New world HW

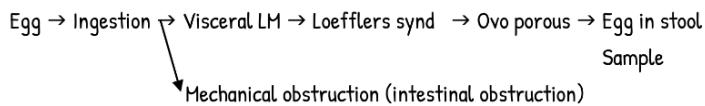
skin

Larva → penet → Cut → Loeffler's → ovo parous → Egg in stool sample

L.M synd.  
 ↓  
 Iron deficiency anemia

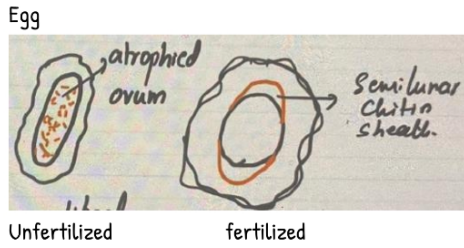


3) *A. Lumbricoides*



# Parasitology - Helminths

Topic Notes: 6



### 4) E. Vermicularis (L.1)

Egg → ingestion → perianal itching → Egg in perianal area → NIH swab  
 → Appendicitis, Autoinfection

Egg



### 5) T. Trichura. (L.1)

Egg → ingestion → Chronic dysentery → Iron deficiency anemia → Egg in stool Sample  
 → Rectal prolapse

### 6) Filarial Worm: Filariasis

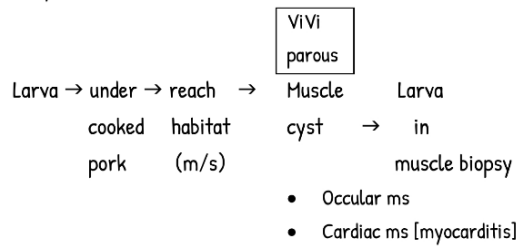


Larva → culex bite → reach habitat → vivi parous → Filariasis → Larva in blood  
 ↓  
 Occult filariasis → mayer kuwenaar synd  
 Tropical pulm Eosinophilia → Weingarten synd

## Parasitology – Helminths

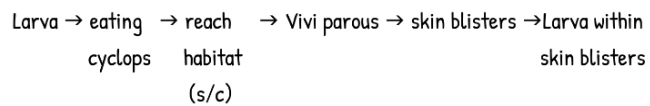
Topic Notes: 6

### 7) T. Spiralis



Bachmann i.d test → tve

### 8) D. medinensis



- Non - Bile stained Eggs
  - Necator Americanus
  - Enterobius Vermicularis
  - Hymenolepis Nana
  - Ancylostoma duodenale
- Egg floats in saturated salt solution
  - Trichuris Trichura
  - Enterobius vermicularis
  - Hymenolepis Nana
  - Ancylostoma duodenale
  - (Necator Americanus)
  - A scaris Lumbricoides
  - (Fertilized egg)

# Mycology

## Fungi

### Yeast



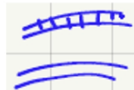
- Cryptococcus

### Yeast-like



- Candida
- Malassezia

### Moulds

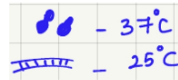


- ↓
- Aseptate moulds, obtuse (or) right angle
- Rhizopus
  - Absidia
  - Mucor

- Septate with acute angle
- Aspergillus

- Septate with irregular branching
- Dermatophytes

### Dimorphic



- Histoplasma
- Blastomyces
- Coccidioides
- Sporothrix schenckii
- Penicillium marneffi

## FUNGAL SPORES

03:34

### Fungal spores

#### Sexual spores

##### Ascospore



- Septate moulds
- Dimorphic fungi

##### Basidio spore

- Yeast
- Yeast like (except c. albicans)

##### Zygospor.

- Ascptate moulds

#### Asexual spores

##### Arthrospores

- Tricosporon

##### Blastospores (Budding Yeast Cells)

- Yeast
- Yeast like

##### Chlamydo spores

- C. albicans
- C. dublinensis

##### Sporangiospores

- Aseptate mould

## FUNGAL DISEASES

05:25

- 1) Superficial mycoses
  - Tinea Versicolor
  - Piedra
  - Dermatophytoses
  
- 2) Deep mycoses / Subcutaneous mycoses
  - Mycetoma
  - Sporotrichosis
  - Chromoblastomycosis
  - Pheohyphomycosis
  
- 3) Systemic mycosis / Endemic mycoses
  - Histoplasmosis
  - Blastomycosis
  - Coccidiomycosis
  - Paracoccidiomycosis
  
- 4) Opportunistic mycoses
  - Candidiasis
  - Cryptococcosis
  - Aspergillosis
  - Mucormycosis
  - Pneumocytosis

## SUPERFICIAL MYCOSES

7:22

- 1) Tinea Versicolor / *Pytirisias versicolor*  
Features: Hypo / Hyper pigmented patches  
↓  
Upper trunk  
Org: *Malassezia* (*M. Globosa* > *M. Furfur*)  
Diagnosis:
  - SDA = Fried egg colonies
  - G/S = Sphagetti and meat ball app.
  - Wood's lamp = Golden yellow fluorescence

2) PIEDRA

10:13

**White piedra**

C/P → White color nodules on hair shaft

Org → *Trichosporon bejiilli*

Δ<sup>st</sup> → SDA → White colonies  
Gs/LPCB → Arthrospores

**Black piedra**

Black color nodules on hair shaft

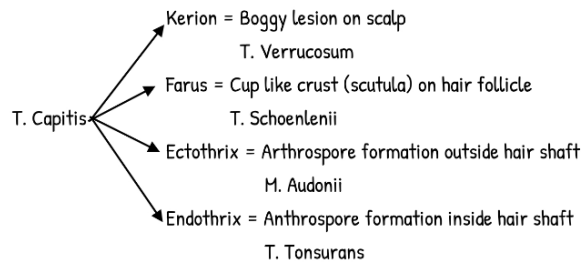
*Piedra hortae*

Brown - Black Growth Ascospores

3) DERMATOPHYTOSIS / TINEASIS

11:03

Features: Dry skin with skin rashes (ring worm)





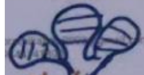


Org: Dermatophytes → *Tricophyton*  
*Microsporum*  
*Epidermophyton*

Diagnosis:

SDA = White cottony growth

LPCB = Septate hyphae with conidia

Dermatophyte →	<i>Tricophyton</i>	<i>Microspores</i>	<i>Epidermophyton</i>
Micro conidia	 Abundant	 Few / absent	absent
Macro conidia	 Pencil	 Spindle / boat	 Club

Wood lamp → Apple green fluorescence (M. Canis = M.C)

Hair perforation test → +ve → *T. Mentegrophytes*

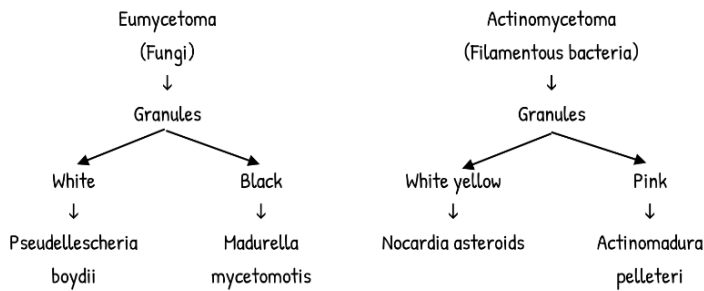
**DEEP MYCOSES / SUBCUTANEOUS MYCOSES**

15:56

**Mycetoma**

Features: S/c swellings → sinuses → Discharging granules

Org:



**SPOROTRICOSIS**



17:08

Sporotrichosis / Rose Gardner's disease

(Subhimalyan region)

C/p → S/c nodules along lymphatics

Org: → Sporothrix schenki

Δ<sup>sis</sup> → Sample (PAS) →  → asteroid body  
 → culture (LPCB) →  Flower like pattern (25°C)

**CHROMOBLASTOMYCOSIS**

19:12

C/P → S/c nodules, ulcers, verrucous lesions

Org → Peoid fungi

Producing medular bodies →  → Copper penny app. (Sclerotic bodies)

**Pheohypomycosis**

C/p → S/c nodules, ulcers, verrucous lesions

Org → Pheoid fungi do not produce medlabodies

### SYSTEMIC MYCOSES / ENDEMIC MYCOSES

20:18

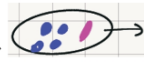
Histoplasmosis

Features: Pulmonary

Cutaneous

RES

Org: Histoplasma Capsulatum

Diagnosis: PAS (sample) →  → Intracellular yeast

Culture (SDA) →  → Tuberculate conidia

### BLASTOMYCOSIS

21:56

C/P → pulmonary, cutaneous

Org → Blastomyces


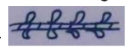
Δ<sup>st</sup> → Sample (PAS) →  → Broad base budding yeast  
(or)

Figure of 8 appearance

→ Culture (LPCB) →  → pear shape conidia  
25°C along the hyphae

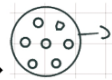
### COCCIDIOMYCOSES


21:59

Features: Pulmonary

Cutaneous

Org: Coccidioides

Diagnosis: PAS (Sample) →  → Spherules containing endospores

LPCB (Culture)  
(25°C) →  → Arthroconidia with fragmented hyphae

## ← Mycology

Topic Notes: 8

### PARACOCCIDIOMYCOSIS


23:22

Features: Pulmonary

Org: Paracoccidioides

Diagnosis: PAS (Sample) →  → Mickey mouse (or) pilot wheel app.

LBCB (culture)

At 25° c →  → pear shaped conidia along hyphae

### OPPORTUNISTIC MYCOSES


23:42

Candidiasis

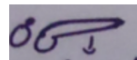
Features → Cutaneous, Mucocutaneous, Invasive

Agent → Candida

Diagnosis: → SDA → White colonies

→ G/S →  Budding yeast cells  
 ⌊ pseudohyphae

→ GTT (Germ Tube Test)

 → • C. albicans  
 Germs tube • C. dublinensis

→ BDG marker for invasive candidiasis

### CRYPTOCOCCOSIS


26:40

C/P → Pulmonary, meningitis, Cutaneous, Invasive

Agent → Cryptococcus

Δ<sup>sis</sup> → SDA → Muroid cream color colonies

→ G/S →  Budding yeast cells

→ Negative staining →  Capsule (only Capsulated)

→ Bird seed agar → Brown colonies (Melanin pigment)

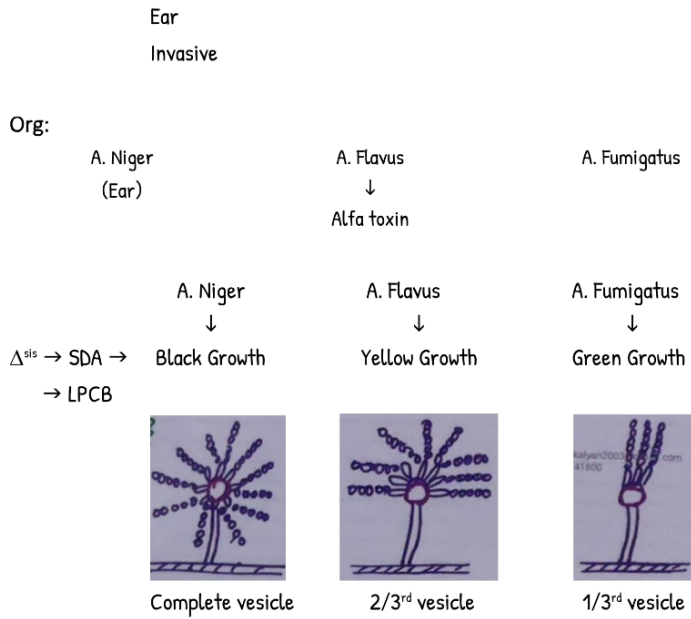
### ASPERGILLOSIS

28:42

Features = Pulmonary

Para nasal sinus

← **Mycology**  
Topic Notes: 8



Galactomannan = Marker for invasive aspergillosis

**MUCORMYCOSIS**

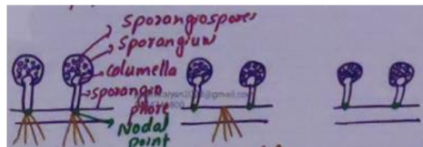
30:42

C/P → Rhinocerebral, pulmonary, cut, invasive

Org → Rhizopus (m.c)      Absidia      Mucor

Δ<sup>sis</sup> → SDA → White cottony      white cottony      white cottony  
Black dots  
(Salt & Pepper)

→ LPCB



Nodal rhizoids	Internodal rhizoids	No rhizoids
-------------------	------------------------	----------------

## PNEUMOCYTOSIS

34:28

Features = Pulmonary

[PcP = pneumocystis carinii pneumonia]

Org = Pneumocystis Carinii / jirovecii

Diagnosis = SDA = Non - cultivable

= PCR

= GMS (sample) = Black cysts



Ping pong ball app.

# Immunology

Topic Notes: 9

## Immunology

- Topics to be covered:
  1. Immunity
  2. Antigen
  3. Antibody
  4. Antigen-antibody reactions
  5. Immunodeficiency disorders
  6. Hypersensitivity
  7. Transplant immunology

### IMMUNITY

00:30

- Innate immunity:
  - Present since birth
  - 1<sup>st</sup> line defence mechanism: action in 3-4 hours
  - Non-specific
  - No memory
- Mechanism of innate immunity:
 

Organism → PAMP (Pathogen Associated Molecular Pattern)

↓

Host Cell receptors (PRR: Pattern Recognition Receptors)

Eg: TLR - Toll Like Receptors

↓

Host Cells → Macrophages - phagocytosis; NK cells - Cell lysis

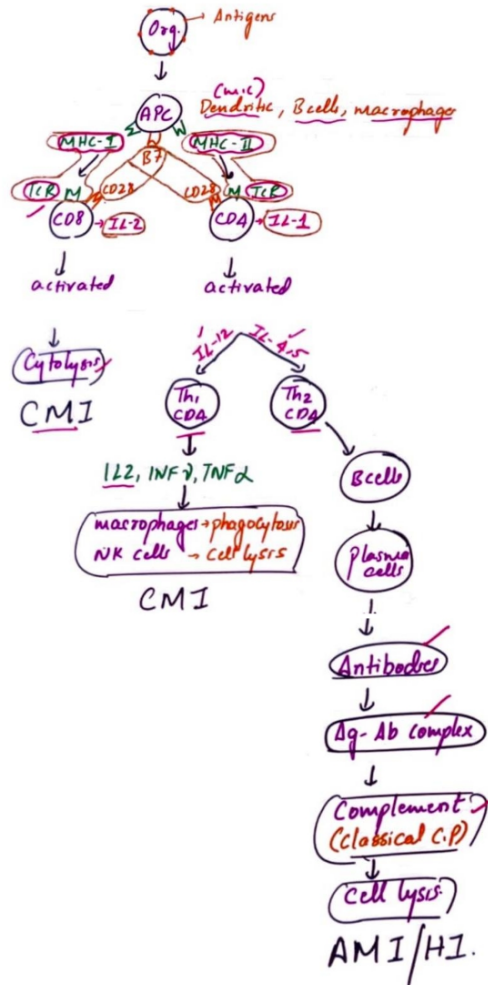
↓

Cytokines IL-1, IL-6, TNF- $\alpha$ , Inflammation

↓

Acute Phase Reactants → Complement → Alternate, Lectin CP
- Acquired Immunity (Adaptive Immunity)
  - Acquired after the entry of pathogen
  - 2<sup>nd</sup> line defence mechanism → 5-7 days
  - Specific
  - Memory

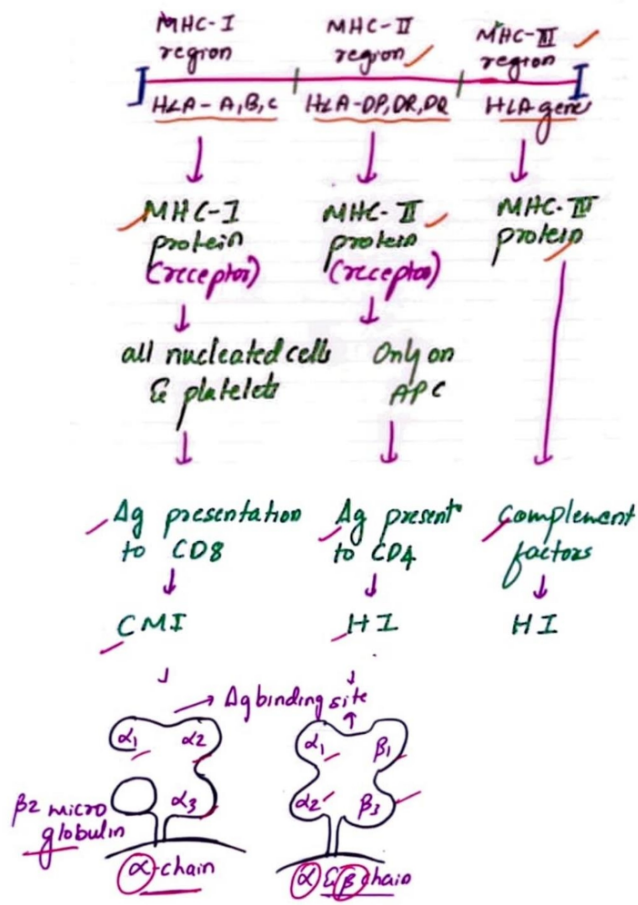
- Mechanism of acquired immunity:



### MHC/HLA ANTIGENS

11:42

- MHC/HLA genes → Short arm of chromosome 6.



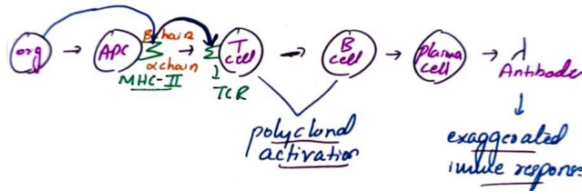
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ANTIGENS

16:38

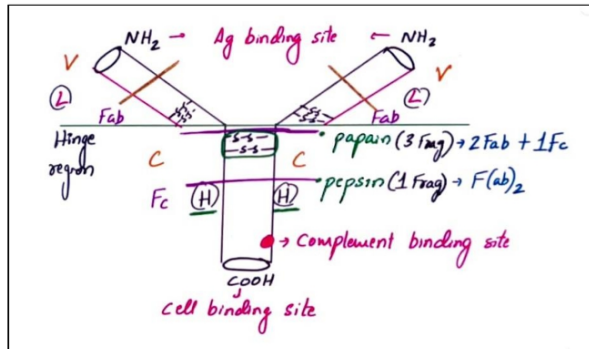
- Superantigens are antigens which directly binds to lateral side of  $\beta$ -chain of MHC-II receptor.



- Example:
  - TSST-Type-1 & Enterotoxin  $\rightarrow$  Staphylococcus aureus
  - TSST type-2  $\rightarrow$  Streptococcus pyogenes
- Heterophile antigen: Sharing of antigen by 2 different organism/cells.
- Example:
  - EBV Ag & Sheep RBC Ag  $\rightarrow$  Paul Bunnell test
  - Rickettsia Ag & Proteus OXK, 2, 19  $\rightarrow$  Weil Felix test

ANTIBODIES

21:11



- IgG:
  - Monomers
  - Highest serum concentration
  - 4 serotypes:
    - G1
    - G2: Doesn't cross placenta
    - G3

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- G4: doesn't fix complement
- Functions:
  - Fix the complement
  - Crosses placenta → Immunity to the baby
  - Precipitation and neutralization
- IgM:
  - Pentamer (J chain)
  - Highest molecular weight
  - Functions:
    - Fix the complement
    - Agglutination Ag-Ab reaction
- IgA:
  - Types:
    - Blood IgA: Monomer
    - Secretory IgA: Dimer (J chain)
  - Functions:
    - Secreted in breast milk → local immunity to the baby
- IgD:
  - Monomer
  - IgD and IgM are surface receptors on B-cells
- IgE:
  - Monomer
  - Elevated in:
    - Hypersensitivity type 1
    - Helminthic infection

## ANTIGEN ANTIBODY REACTION

32:29

- i) Precipitation:
- Soluble Ag + Specific Ab → Precipitates (Floccules)
  - Eg:
    - Tube flocculation: Kahn test
    - Slide flocculation: VDRL, RPR } T. Pallidum
    - Tube precipitation: Ascoli Thermo precipitation → B. Anthrax
    - Plate precipitation: Elek's gel precipitation → C. Diphtheriae

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- Immunodiffusion test:
  - Oudin → Single diffusion in single dimension
  - Ouchterlony → Double diffusion in double dimension
- ii) Agglutination:
  - Insoluble antigen + specific ab → Agglutination
  - Eg:
    - WAT (Widal) → Salmonella
    - SAT (Standard) → Brucella
    - MAT (Microscopic) → Leptospira
    - LAT (Latex) → capsule
    - HAT (Heme) → Fimbria
  - Heterophile agglutination test:
    - Paul Bunnell → EBV
    - Weil-felix: Rickettsia
    - Cold agglutination } Mycoplasma
    - Streptococcal MG }
- iii) Neutralization:
  - Eg:
    - Toxin neutralization: Naeglar reaction → Clostridium perfringens a toxin
    - Virus neutralization: PRNT → Viral quantification

## IMMUNODEFICIENCY DISORDERS

36:29

- I. Humoral IDD (B-cell defect):
  - a. X-linked agammaglobinemia (Bruton's disease)
    - Tyrosine kinase enzyme deficiency
    - Pre-B-cells is not converted to B-cells
  - b. Combined variable deficiency
    - Intrinsic B-cell defect
    - B-cells will not get converted to plasma cells
  - c. Selective IgA deficiency:
    - Cytokine defect
    - Plasma cells will not secrete IgA
- II. Cellular IDD (T-cell defect):
  - a. DiGeorge syndrome:
    - Chromosome 22q11 defect
    - Thymic hypoplasia → T-cell maturation defect

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- b. PNP (Purine Nucleoside Phosphorylase) deficiency disorder
  - PNP deficiency
  - Purine is not converted to hypoxanthine
  - Purine accumulates
  - Purine is toxic to T-cells
- c. Chronic Mucocutaneous Candidiasis:
  - ? → T cell defect → CMI deficient
- III. Combined IDD (Both B-cell and T-cell defect)
  - a. SCID (Severe combined immunodeficiency syndrome)
    - X-linked: IL-7 deficiency → Lymphopoietic growth defect (T and B cell)
    - AR: ADA deficiency, JAK-3 mutation, RAG mutation
  - b. Wiskott Aldrich syndrome (X-linked disease)
    - WASP gene mutation → WASP protein is not formed → Precursor lymphoid cells is not converted into Lymphoid cells (T & B-cells)
  - c. Ataxia telangiectasia:
    - Kinase enzyme deficiency
    - T & B-cell defect
- IV. Phagocytic disorders:
  - a. Chronic granulomatous disorders (X-linked/AR)
    - NADP oxidase enzyme deficiency → Defective oxidative burst → Ineffective phagocytic killing
  - b. Chediak Higashi disease (AR):
    - LYST gene mutation → Phagosome-lysosome fusion will not occur.
  - c. Job's syndrome (Hyper IgE syndrome):
    - AD: STAT-3 mutation
    - AR: DOCK-8 mutation
    - Defect in neutrophil chemotaxis
- V. Complement deficiency disorders:
  - a. C<sub>1</sub>, C<sub>2</sub>, C<sub>4</sub> deficiency: SLE
  - b. C<sub>3</sub> deficiency → GN
  - c. C<sub>5b,6,7,8,9</sub> (MAC) deficiency → Disseminated infections
  - d. C1 esterase deficiency → HAE
  - e. DAF deficiency → PNH
  - f. Factor I & Factor H deficiency: Recurrent pyogenic infections

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## HYPERSENSITIVITY REACTION

47:25

- I. Type I hypersensitivity:
  - Immediate type (20-30 minutes)
  - Extracellular antigen
  - Humoral immune response (IgE)
  - Examples:
    - Allergic rhinitis
    - Allergic dermatitis
    - Bronchial asthma
    - Anaphylaxis
- II. Type II hypersensitivity
  - Immediate type (2-3 hours)
  - Cell bound antigen
  - Humoral immune response (IgG)
  - Examples:
    - Hemolytic anemia
    - Transfusion reactions
- III. Type III hypersensitivity
  - Immediate type (2-3 hours)
  - Extracellular Ag
  - Humoral immune response (IgG)
  - Ag-Ab (IgG) complex
  - Examples:
    - Glomerulonephritis
    - Rheumatoid arthritis
    - Goodpasture's syndrome
    - Arthus reaction
    - Serum sickness
- IV. Type IV hypersensitivity
  - Delayed type (2-3 days)
  - Intracellular Ag
  - Cell mediated immunity (T<sub>DTH</sub> cells)
  - Examples:
    - Tuberculin test
    - Lepromin test

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## TRANSPLANT IMMUNOLOGY

52:00

### I. Graft rejection:

*Recipient*  $\xrightarrow{\text{Immune Response}}$  *Graft*

- a. Acute: weeks – months
  - Major: CMI (CD8 T-cells)
  - Minor: HI (Antibody)
- b. Chronic: Months to years
  - Major: CMI (T<sub>DTH</sub>-cells)
  - Minor: HI (Antibody)
- c. Hyperacute: Minutes to hours
  - HI (pre-existing antibodies)
  - Previously received blood transfusion or organ transplantation from same patient

### • Prevention:

- HLA compatibility testing
- ABO incompatibility testing
- Immunosuppression drugs

### II. GVHD (Graft Vs Host disease)

*Graft (Immunocompetant T – cells)*

$\xrightarrow{\text{Immune Response}}$  *Recipient (Immunocompromised)*

- Bone marrow or thymus transplantation
  - a. Acute: within 100 days
  - b. Chronic: After 100 days
- Treatment: Glucocorticoids