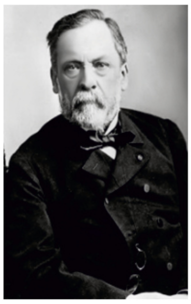
Yourwish

1. GENERAL MICROBIOLOGY

SCIENTISTS

00:00:17

Louis pasteur	Robert Koch
• Pasteur Institute, Paris • Father of Modern Microbiology **Contributions** • Pasteurisation • Liquid media • Fermentation principle • Autoclave • Disapproved of the Theory of abiogenesis • Germ cell theory **Vaccines discovered** • Cholera vaccine • Anthrax Vaccine • Rabies vaccine 	• Koch postulates • Father of bacteriology NEET PG 2023, NEET PG 2024 **Discovery** • Koch bacilli (TB) • Cholera organism **Contributions** • Solid culture media • Aniline dye colour • Hanging drop motility (test) 

Koch postulates

00:03:10

- Constant association of the causative organism with the disease.
  - E.g., MTB causes TB
- Isolation in culture media is possible.
  - E.g., TB can be cultured in LJ media
- Culture growth inoculated in an animal should produce the same lesion
- Re-isolation from the experimental animal is possible
- Every bacterium has an antigen, and when it enters the body, antibodies are produced

Koch postulates- exceptions

00:04:45

- 3 bacteria that don't follow Koch's postulates
  - **L**- Mycobacterium **l**eprae.
    - → Cannot be grown in culture media.
    - → It is grown only in animals, Armadillo
  - **P**- Treponema **p**allidum
  - **G**- **G**onococci

Other important scientists

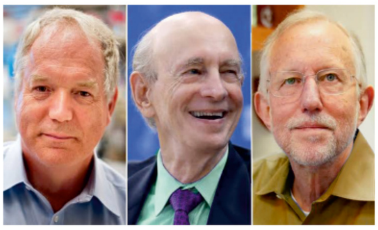
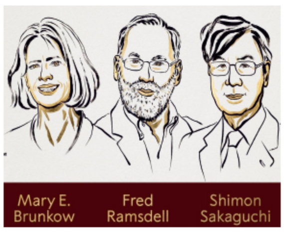
00:05:20

NEET PG FMGE 2022

Paul ehrlich	• Ehrlichia • Father of chemotherapy • Toxin-antitoxin (received Nobel prize)- E.g., Diphtheria toxin is treated with Diphtheria antitoxin • Acid-fast (ZN stain)
Joseph Lister	• Father of antiseptic surgery
Anton Von Leeuwenhoek	• Invented the light microscope • Called the organisms as Animal cules
Ernst Ruska	• Invented the electron microscope
HC gram	• Gram stain
Edward Jenner	• Smallpox vaccine • Eradicated in 1980 • Prepared using the Cowpox virus
Karry B Mullis	• PCR
Alexander Flemming	• Penicillin
Kleinberger	• L forms (cell wall deficient)
Barbara McClintock	• Transposons/Jumping genes

Important nobel prize winning scientists

00:08:22

HCV pathogenesis	
CRISPR Cas9 Gene editing tool	 
Peripheral immune tolerance Awarded in 2025	

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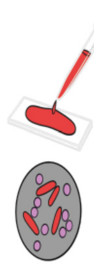
STAINS

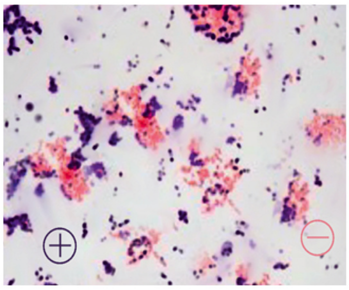
00:09:45

Differential stains

Gram stain

AIIMS 2021

Come	In	And	Stain
Crystal violet- Primary stain	Iodine- Mordant (fixer)	Alcohol/Acetone- Decolourizer	Safranin red- Secondary stain
			

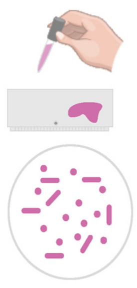
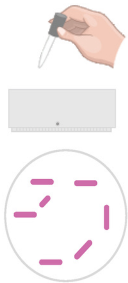
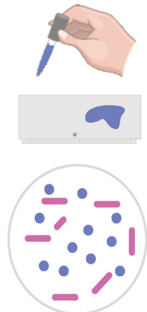


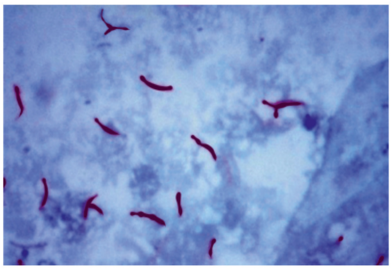
- **Crucial step of Gram staining- Decolourizer**
- Gram-negative organisms (Mnemonic: MRCS)
  - Mycoplasma
  - Rickettsia
  - Chlamydia
  - Spirochetes

Ziehl neelsen stain

00:12:34

FMGE 2021

Class	Has	Asked	Mnemonic
Carbol Fuschin- Primary stain	Heat- Mordant	Acid (H_2SO_4) alcohol- Decolourizer	Methylene blue/ Malachite green- Secondary stain
			



- Concentration of H_2SO_4 for different organisms
  - MTB: 20-25%
  - M. lepra: 5% (Fite foracco stain)
  - Coccidean parasites: 5%
  - Nocardia, Legionella: 1% (Modified ZN stain)
  - Spores, Head of sperm: 0.25-0.5%

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Acid fast organisms

00:15:32

My	• **MY**cobacteria: TB, Atypical, Lepra
Nose	• **No**cardia • Legionella
IS	• **Is**ospora • Sperm • Spore
Cold	• **C**yclospora • **C**ryptosporidium
Hot	• **Ho**okler hydatid • Taenia saginata

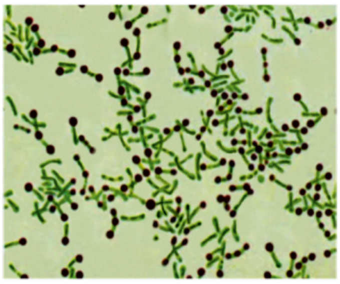
- If heating is skipped → Cold ZN stain/Kinyoun/Gabbett stain
  - Used for Coccidian parasites
    → Isospora, Cyclospora, and Cryptosporidium
  - As the mordant is removed, Carbol Fuschin is increased (increase in phenol concentration)

Albert stain

00:17:40

AIIMS 2022

- Done is bacteria with Volutin granules/Bipolar granules/Babes Ernst granules/Metachromatic granules. E.g., C. diphtheria
- Albert solution 1- Toluidine blue, Malachite green, Glacial acetic acid
  - Toluidine blue is a metachromatic stain: It is blue, but on staining, it gives a purple colour
- Albert's solution 2- Iodine
- Manual preparation of stain: Order of adding solutions
  - **T**oluidine blue
  - **I**odine
  - **M**alachite green



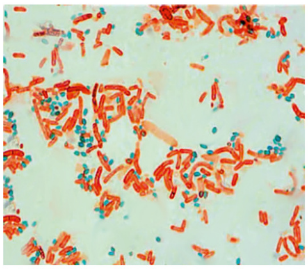
- Other stains for volutin granules
  - **P- P**onder's stain
  - **L- L**oeffler methylene blue stain (Best)
  - **A- A**lbert stain
  - **N- N**eisser stain

Miscellaneous stain

00:20:17

Spore stains

- Spore is a dormant stage of a bacterium
- Stains
  - ZN stain (0.25-0.5% H_2SO_4)
  - Schaeffer and Fulton stain/Modified Ashby stain
    → Malachite green + Safranin red



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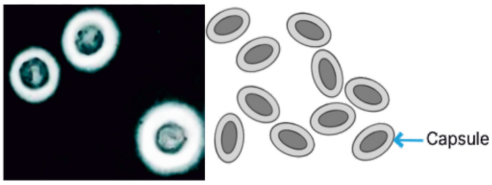
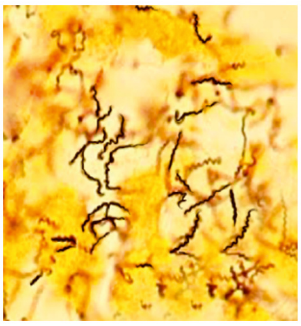
Negative stain

- Background- Stained
- Organism- Unstained
- For- Cryptococcus
- E.g., of negative stain
  - India Ink
  - Nigrosin



Silver stain

- Silver impregnation- Black
- For- Spirochetes
- E.g., of Silver stain
  - Levaditi
  - Fontana



Leifson and ryu's stain

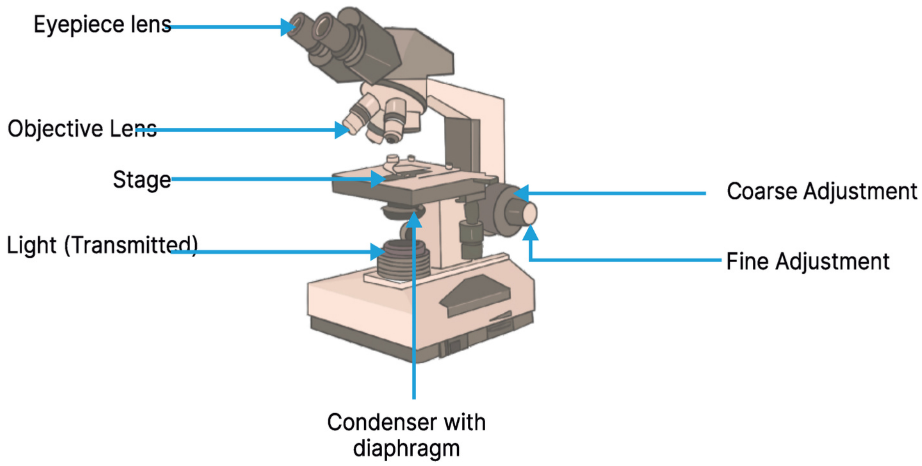
- For locomotion → Flagella
- Mordant- Tannic acid

MICROSCOPES

00:24:00

Light microscope

AIIMS 2018



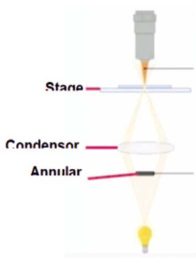
- Objective lens
  - Scanner- 4x
  - Low power- 10x
  - High power- 40x
  - Oil immersion- 100x
- Eypiece lens- 10x
- Total magnification= Objective lens x Eyepiece lens
- Maximum magnification= 1000x

Dark field microscope

00:27:12

FMGE 2021, NEET PG 2021

- Uses reflected light
- Annular diaphragm allows only light to pass at the peripheries
- Used for very thin structures
  - Spirochetes
  - Flagella

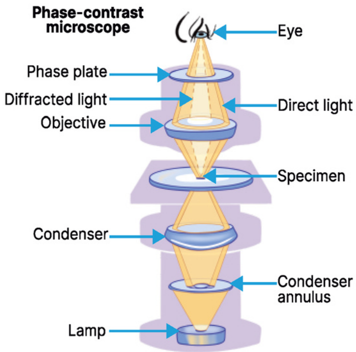


Phase contrast microscope

00:28:30

AIIMS 2022, INICET 2024

- Parts added
  - Annular diaphragm in front of the condenser
  - Annular phase plate
- Principle: Difference in intensity
- Use: For internal details
- Used for Hairy cell leukemia



Interference contrast microscope

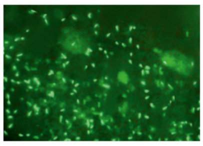
00:30:25

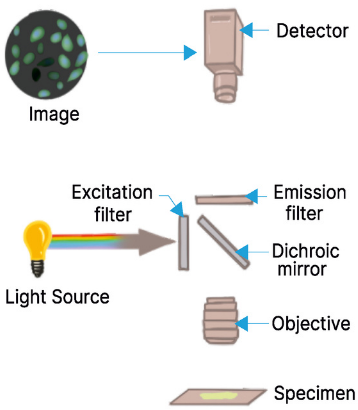
- Reveals cell organelles
- Measurement of chemical constituents of cells, such as lipids, proteins, and nucleic acids

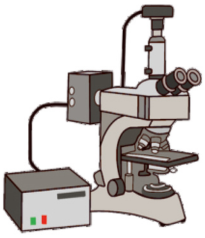
Fluorescence microscope

00:30:55

- Light source: UV
- Mirror used: Dichroic
- Principle: Shorter wavelength to longer wavelength by the fluorescent dye
- Dyes:
  - TB- Auramine, Rhodamine
  - Malaria- Acridine orange
  - Fungus- Calcofluor white
  - Flow cytometry- FITC (Fluoro Iso Thio Cyanate)
- Autofluoresece
  - Isospora, Cyclospora
  - NADPH
  - Formalin (skin biopsy)







Electron microscope

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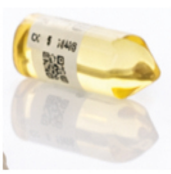
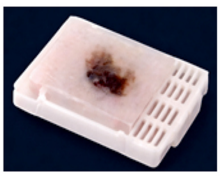
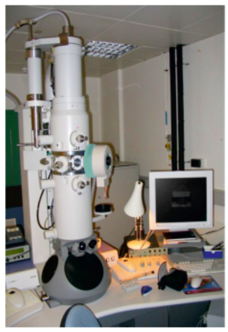
Electron microscope	Features	Light microscope
• 2-2.5% Glutaraldehyde	**Fixation**	10% neutral buffered formalin
• Resin 	**Embedding**	Paraffin wax 



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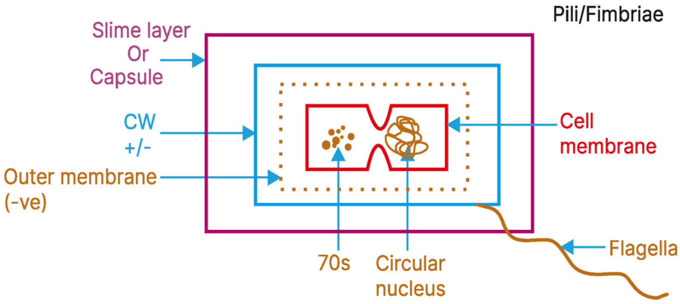
• Metal (copper)	**Slide**	Glass
• Electrons	**Source**	Light
• Vacuum	**Medium**	Air
• Higher	**Resolution**	Lower

Types

Scanning electron microscope	Features	Transmission electron microscope
• Scattered electrons	**Principle**	• Transmitted electrons
• 3D	**Dimension**	• 2D
• More samples viewed in less time	**View and time**	• Fewer samples viewed in the same time
• Surface details	**Details**	• Internal details

BACTERIAL ANATOMY

00:38:20



Capsule and slime layer

FMGE 2019

- Capsule- Rigid
- Slime layer- Loose
- Streptococcus salivaris has both a capsule and a slime layer
- Capsulated bacteria **(Mnemonic: Pretty & NIce Capsules)**
  - Streptococcus **p**neumoniae
  - Klebsiella **p**neumoniae
  - Bordetella **p**ertussis
  - Vibrio **p**arahaemolyticus
  - Clostridium **p**erfringens
  - Yersinia **p**estis – F1 Peptide
  - **N**eisseria meningococcus
  - Hemophilus **i**nfluenza
  - **C**ryptococcus
  - Bacillus **a**nthracis- Polypeptide
- All capsulated bacteria are made of polysaccharides except Yersinia pestis & Bacillus anthracis, which are made of polypeptides.

Demonstration

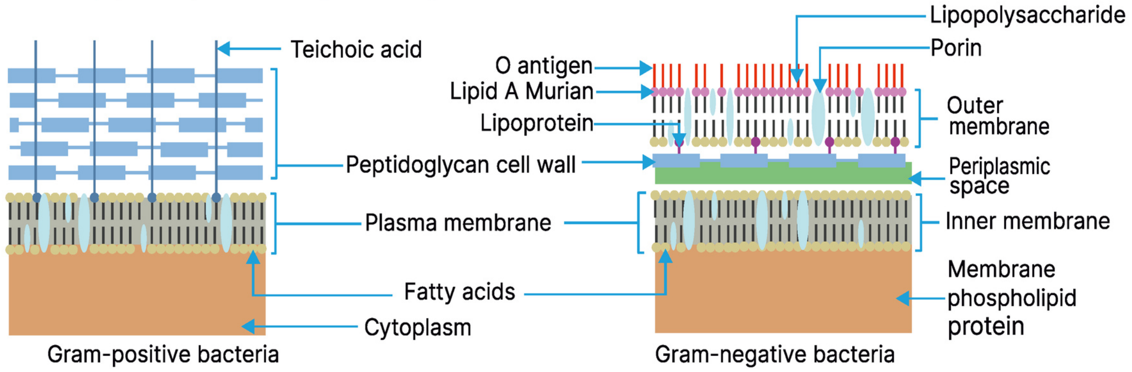
McFadyean reaction
For polypeptide bacteria- B. anthracis
Add polychrome methylene blue= Capsule turns purplish

Quellung reaction/Neufeld reaction
For polysaccharide bacteria- Pneumococcus
Capsule Ag + antisera= Swelling around (Quellung reaction +ve)

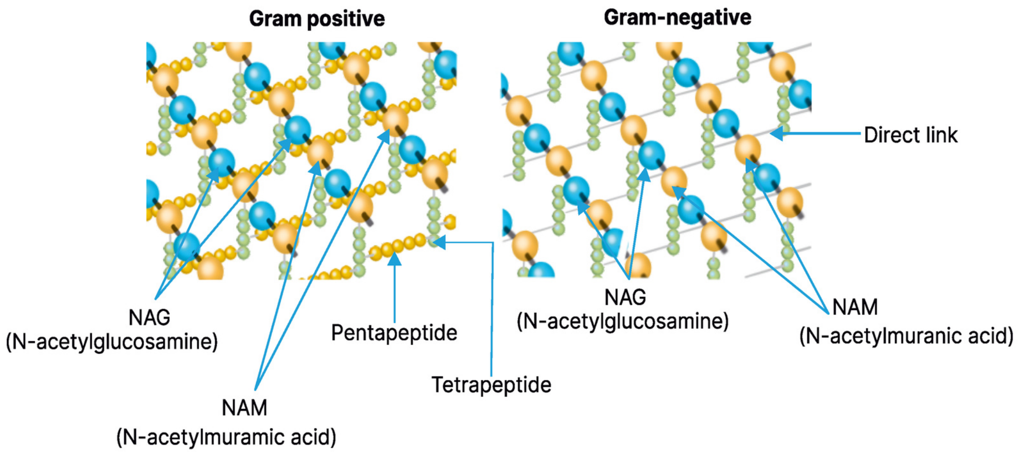
Cell wall

00:41:37

Method to identify gram-positive & gram-negative bacteria



P	P	P	T
Gram Positive	Peptidoglycan	Penta Peptide Crossbridge	Techoic acid (attachment)



- Both Gram-positive and Gram-negative bacteria have NAG (N-acetylglucosamine) and NAM (N-acetylmuramic acid)
- But in Gram-positive bacteria, 2 NAM molecules are connected by a penta-peptide crossbridge

Gram-positive	Features	Gram-negative
• No	**Lipid content**	• Yes
• Peptidoglycan	**Composition**	• Lipopolysaccharide (minimal Peptidoglycan) ○ Region I- **O** Ag (Variable) ○ Region II- Polysaccharide ○ Region III- Lipid **A** (endotoxin)

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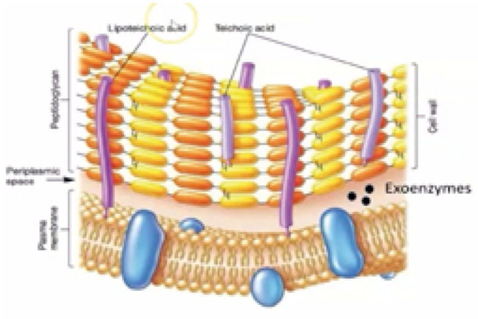
• Penta-peptide crossbridge	**NAM-NAG**	• No
• Yes	**Teichoic acid**	• No
• No	**Outer membrane**	• Yes
• No	**Periplasmic space**	• Yes • Specifically seen Spirochetes, which have endoflagella • Between the peptidoglycan and the plasma membrane 

Endotoxin vs exotoxin

00:46:10

Endotoxin	Exotoxin
• Present in the cell wall of all Gram-negative bacteria • Prenst in the Lipid A layer of the cell wall • Endotoxin release on bacterial lysis • Responsible for shock, sepsis	• Present in all bacteria • Exotoxins are small proteins that are secreted

Important Information

- Peptidoglycan + Techoic acid → Gram positive
  - EXCEPT MTB (Peptidoglycan + Lipoarabinomannan/LAM + Mycolic acid)
- Peptidoglycan + Lipopolysaccharide (LPS) → Gram-negative
  - EXCEPT Neisseria (Peptidoglycan + Lipooligosaccharide/LOS)

Mesosomes/chondroids

00:48:30

- Mesosomes are invagination of the cell membrane
- Function as a respiratory unit
- More prominent in gram-positive > gram-negative bacteria

Ribosomes

- 70s ribosomes are seen in a bacterium

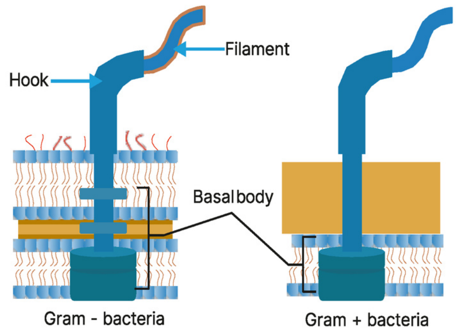
Dna

- DNA is single and circular in bacterium

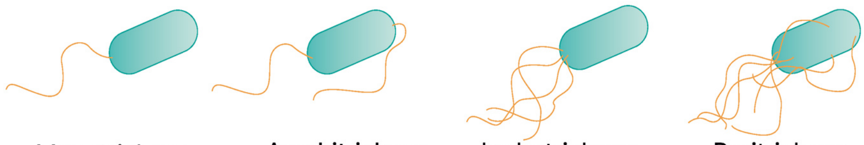
Flagella

NEET PG 2020

- Contains H Ag
- Widal test in Typhoid
  - O Ag- Cell wall
  - H Ag- Flagella
- Flagella have 3 parts:
  - Basal body- 4 rings in GN; 2 rings in GP
  - Hook
  - Filament
- Seen under Dark field motility
- Leifson & Ryu stain

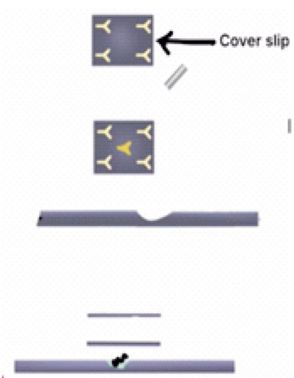
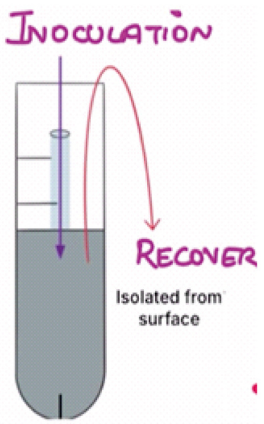
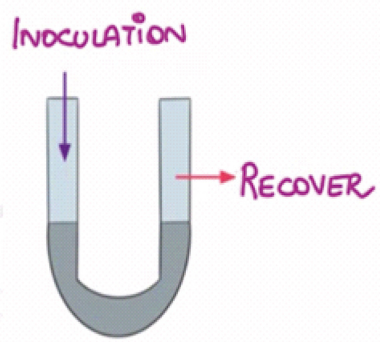


Locations



Monotrichous	Amphitrichous	lophotrichous	Peritrichous
Vibrio Cholera	Pseudomonas	Bacters	E Coli Proteus Listeria

Demonstration of motility

Hanging drop motility	Craige's tube	U tube
• Bacteria are placed on a cover slip, and the cover slip is flipped. With the cover slip inverted and with a hanging drop, bacterial motility could be observed	• If the bacteria had inoculated in a tube, a non-motile bacterium would deposit at the bottom of the tube, but a motile bacterium would reach the surface	• If the bacteria are placed on the side and incubated overnight. If the bacterium is recovered on the other side, it proves that the bacterium is motile.
		

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Types of motility

00:54:40

- Tumbling- Listeria
  - (present at 22-25°C and absent at 37°C)
- Differential motility- Listeriosis, Yersiniosis
- Shooting star/Darting- Vibrio, Campylobacter
- Corkscrew- Treponema pallidum
- Lashing- Borrelia
- Falling leaf- Giardia lamblia
- Twitching- Trichomonas
- Swarming:
  - Proteus,
  - Vibrio parahemolyticus
  - Clostridium tetani
  - Bacillus cereus
  - Serratia

Fimbriae/pili

00:57:22

NEET PG 2020

- Hair like
- Purpose- Adhesion (conjugation/sex-duction)
- Type 4 pili are responsible for locomotion → Seen in Neisseria and Pseudomonas.
- Detection
  - Hemagglutination (E.coli, Klebsiella, Gonococci)
  - Surface pellicle (a thin layer is produced at the surface of the broth)

BACTERIAL PHYSIOLOGY

00:58:55

Properties of bacteria

- Oxygen
  - Aerobic- Requires oxygen
  - Anaerobic- Does not require oxygen

Obligate aerobes (O_2+)	Obligate anaerobes (O_2-)	Facultative anaerobes (O_2±)	Microaerophiles (<5% O_2)
Mnemonic- Must Let Nagging Pets Breathe • MTB • Legionella • Nocardia (Filamentous) • Pseudomonas • Bacillus (spore) • Brucells • Bordetella	**Mnemonic- Choked By Air** • Clostridium (spore) • Bacteroides • Actinomyces (Filamentous)	• Staphylococcus • Streptococcus • Enterobacteraciae • Hemophilus • Vibrio	• The bacters

- Capnophilic- Bacteria requiring Co_2

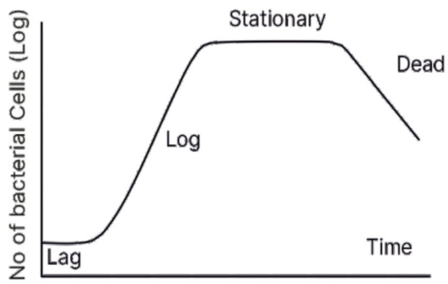
Yourwish

- pH- Lactobacillus survives in acidic pH
- Light- Certain bacteria need light to grow
- Temperature
  - Pschrophile- <20°C
  - Mesophile- 25-40°C
  - Thermophile- > 55-80°C (e.g., Stearothermophilus)

Bacterial growth curve

01:03:00

NEET PG 2021



Lag phase	Log phase	Stationary phase	Death/Decline phase

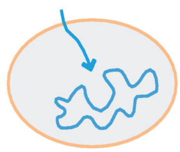
• Number is the same
• Increase in size (accumulates metabolites)
• Maximum size attained at the end of the lag phase
	• Increase in the number
	• Cell division occurs, smaller in size
	• Maximum metabolic activity
	• More susceptible to antibiotics
	• Population doubling time
	  ○ E.coli: 20 min
	  ○ MTB: 20 hrs
	  ○ M. lepra: 20 days
		• Stops dividing
		• Sporulation
		• ExoToxin production
		• Antibiotic production
		• Bacteriocin production
		  ○ Produced by bacteria
		  ○ Inhibits other bacteria
			• Bacteria start dying
			• Involution forms

BACTERIAL GENETICS

01:07:28

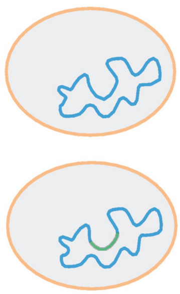
Gene transfer

Transformation



- Transfer of free DNA
  - Throgh cell wall
  - During the log phase
  - Require competence factor
- M/c mode of drug resistance in Streptococcus pneumoniae

Transduction



01:09:20

- M/c mode of drug resistance in Staphylococcus aureus
- Bacteriophage (DNA virus) picks up DNA from one bacterium and delivers it to another bacterium

Types

Generalized Transduction

Bacteriophage (Blue DNA)

↓

Attaches to the Donor

↓

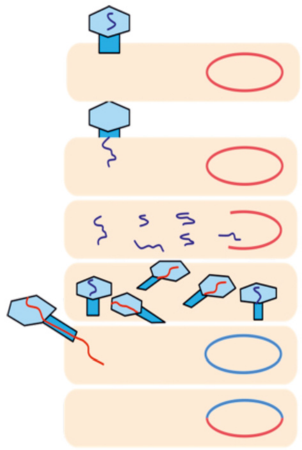
Multiplication in the donor (Bacteriophage with donor DNA and its own DNA are formed)

↓

Released by Lysis

↓

Bacteriophage with donor DNA attaches to the recipient and delivers the donor DNA



Specialized/Restricted transduction

Bacteriophage

↓

Attaches to the Donor through integration

↓

Induction (separation of both bacteriophage and donor DNA)

↓

Formation of new bacteria with a mixture of DNA

↓

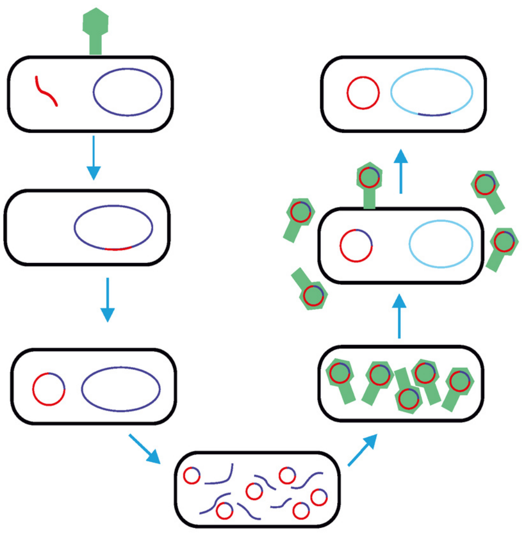
New bacteria attaches with the recipient.

↓

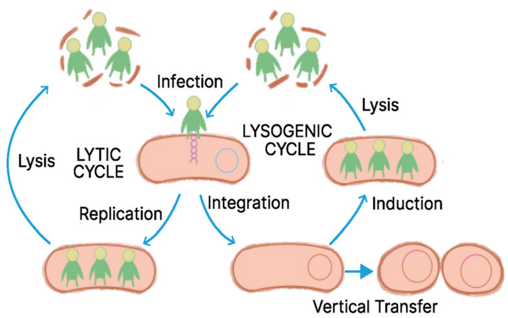
Released by lysogenic

↓

Incorporation of donor DNA



Bacteriophage cycle

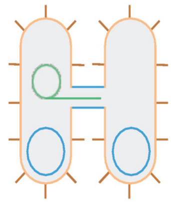


- Lysogenic conversion
  - After the bacteriophage fuses with donor bacteria, but does not undergo induction, it starts to divide into daughter cells, giving new properties to the daughter cells.
- Bacterial toxins coded by lysogenic conversion

- A- A and C pyrogenic toxins of Streptococcus pyogenes
- B- Botulinum toxin C and D
- C- Cholera toxin
- D- Diphtheria toxin
- E- EHEC (shiga-like toxin/verocytotoxin)- Enterohemorrhagic E.coli

Conjugation

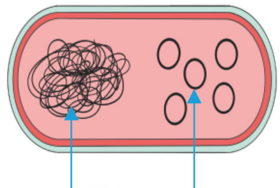
01:16:50



- Donor bacteria come in contact with recipient bacteria to transfer the DNA
- Occurs through fimbriae/pili
- M/c mode of drug resistance- Conjugation

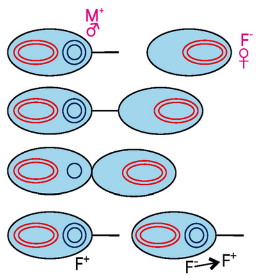
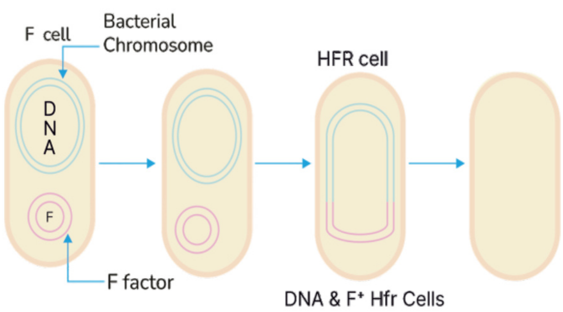
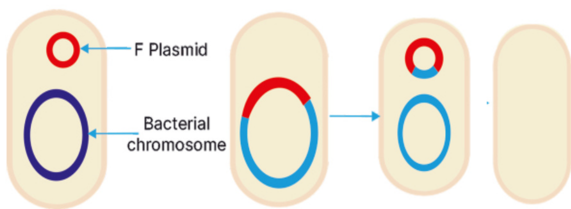
Plasmids

- Extrachromosomal dsDNA circular
- Plasmids are transferred during conjugation between two bacteria
- Plasmids have
  - F plasmid (fertility)
  - R plasmid (resistance)

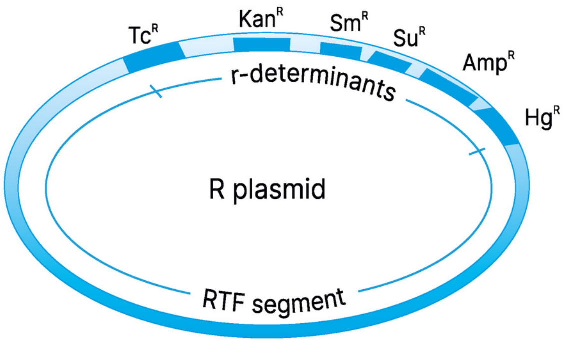


F plasmid- Fertility plasmid

FMGE PG 2023

F+ with F- • F+ or male bacteria- Any bacteria with an F plasmid • F- or female bacteria- Any bacteria without the F plasmid • Conjugation tube forms between F+ and F- • A copy of an F plasmid is transferred into the female bacteria • Both bacteria end up becoming F+	
Hfr with F- • High-frequency recombinant bacteria (Hfr)- DNA fuses with the F plasmid in the same F+ bacteria • Now, a conjugation tube tries to form between the Hfr bacteria and the F- bacteria. • But, the conjugation tube breaks off as a copy of the F plasmid cannot be transferred to F- bacteria from the Hfr bacteria. • F- bacteria continue as it is	
F' with F- • Fusion of DNA and the F plasmid in the bacteria occurs to form Hfr bacteri.a • F' bacteria (male)- F plasmid separates and carries chromosomal genes of Hfr bacteria with it. • F' bacteria conjugates with F- bacteria, there is a copy of the F' plasmid transferred into F- bacteria. • Both bacteria end up becoming F'	

R plasmid- Resistance plasmid

Transferable drug resistance	Mutational drug resistance
• Resistance= Resistance transfer factor (RTF) + Resistance determinant (r) • E.g., if RTF bacteria with 6 (r) are transferred to another recipient bacterium, the recipient bacterium develops resistance to 6 antibiotics at once • More dangerous • Difficult to treat- Multidrug Resistance  	• Easy to treat • Single drug resistance • E.g., TB- Resistant to Rifampicin due to the rpo B gene (mutation)

Crispr-cas9

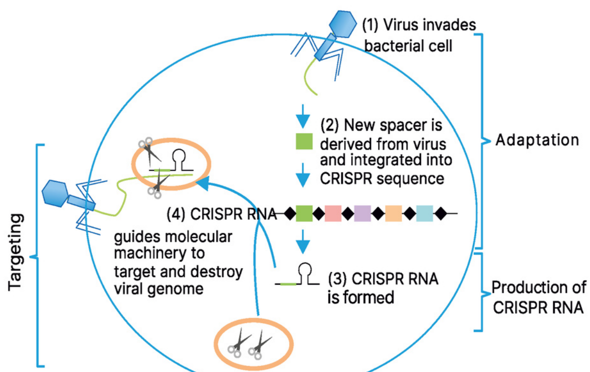
01:26:43

- Bacterial defence mechanism against viruses
- Used for gene editing to treat diseases

- Clustered regularly (pink coloured)- Formation of a cluster (DNA/RNA)
- Short Palindromic Repeats- The clusters have palindrome repeats (same from left to right and right to left)
- Interspaced (purple, red, green, black)- Spaces between the clusters
- CAS9 → Scissors

Mechanism of crispr-cas9

- Bacteriophage attacks a bacterium
- Bacteria take up the DNA (green) of the bacteriophage and store it in their memory
- Bacteria store various bacteriophage DNA (orange, violet, blue) in their memory when attacked
- When a bacteriophage with green DNA attacks, the bacterium produces a CRISPR RNA (green colour)
- CRISPR RNA and CAS9 (scissors) attack the bacteriophage with green DNA and kill it



Yourwish

STERILIZATION AND DISINFECTIONS

01:31:40

FMGE 2022

- Sterilization- Kills the spores
- Disinfections- Do not kill the spores
- Methods: Physical and chemical

Physical methods

Dry heat

- Hot air oven
- Incinerator
- Mechanism **(C.O.D.E)**
  - **C**haring
  - **O**xidative damage
  - **D**enaturation of proteins
  - **E**levation of electrolytes

Hot air oven

FMGE 2022

- Temperature and duration: 160°C for 2 hrs
- Uses: Glassware, cotton swabs, greasy, oily, liquid (paraffin), and dusty (powder) material
- Controls
  - Biological- Spores of B. atropheus/B. subtilis/C.tetani
    → Killing of their spores indicates completion of sterilization
  - Physical- Thermometers/Temperature couplers
  - Chemical- Browne's tube
    → Red colour of the solution turning to green indicates completion of sterilization

Incinerator

- Hospital waste (Biomedical waste- yellow). E.g., Human body parts
- 2 chambers
  - 700-800°C
  - 1000-1100°C

Moist heat

FMGE 2019, INICET 2024, NEET PG 2018

- Residual heat further helps in killing the bacteria and viruses- better method

Below 100°C	At 100°C	Above 100°C
Pasteurisation • Holder method- 63°C for 30 mins • Flash method- 72°C for 20 secs • Flash method is better for killing Coxiella (Q fever)	**Boiling** • Does not kill the spores **Tyndallization** • Kills the spores • Day 1- 100°C for 20 mins • Day 2- 100°C for 20 mins • Day 3- 100°C for 20 mins	**Autoclave** • 121°C for 15 mins at 15 psi • For killing prions- 134°C for 1.5 hrs • Control- Bacillus staerothermophilus

Yourwish

Inspissation • Day 1- 80°C for 20 mins • Day 2- 80°C for 20 mins • Day 3- 80°C for 20 mins • Used for sterilizing LJ, LSS media (as they contain egg) **Water bath** • 60°C for 60 mins		**Uses** • Intruments, aprons, sutures (except catgut), media (except LJ, LSS), sputum

Pressure cooker type

Horizontal autoclave

Vertical Autoclave

Large automatic hospital autoclave

Common laboratory autoclave

Filtration

01:42:10

- Seitz filter (obsolete)
  - Made of asbestos
  - Solution passes through asbestos from the top, and the sterilized solution is collected at the bottom
- Items sterilized with this method- Heat-sensitive substances
  - Vaccines
  - Antibiotics
  - Serum
  - Toxins
  - Sugar solutions
- Average pore size- 0.22
- Air filters:
  - HEPA (High-Efficiency Particulate Air)
  - ULPA (Ultra-Low Penetration Air)
- Control- Brevendimonas diminuta, Serratia

Radiation

01:44:27

Ionising radiation (cold radiation)	Non-ionising radiation (hot radiation)
• They do not increase the temperature • High penetrating power • Sporicidal	• Increases the temperature • Low penetrating power • Bactericidal (not sporicidal)

Examples	Examples
• X-rays • Gamma rays • Cosmic rays **Uses** • Catgut sutures • Grafts **Control** • Bacillus pumilis	• UV rays • Infrared rays **Uses** • OT fumigation • Biosafety cabinet

Chemical methods

01:47:25

FMGE 2020

- Alcohol
  - Ethyl alcohol (70%)- Spirit swab
  - Isopropyl alcohol (70-80%)- Stethoscope, Thermometer
- Formaldehyde
  - Gas- OT fumigation
  - Formalin- Specimen preserve
  - Duckering- Killing Bacillus anthracis spores from animal wool
- Glutaraldehyde
  - CIDEX- All scopes except Arthroscope and Ureteroscope
    → Activated by alkalinization
  - O-phtaladehyde → Ready to use
- Phenols (5%)
- Cresol (1-3%)
- Lysol (2-5%)
- Modified phenols
  - Chlorhexidine + Cetrimide = Savlon (earlier Hibitane/Cetavlon)
  - Chloroxylenol = Dettol
- Iodine
  - Tincture iodine (2% iodine) for skin antiseptic
  - Povidone iodine- Betadine
- Chlorine
  - Most potent
  - 1% sodium hypochlorite- Blood spills

Gas sterilization

01:53:32

- Ethylene oxide (ETO)- Never use 100%
  - Mixed with inert gases ~3% ETO
- Side effects
  - Highly inflammable
  - HighlyIrritant
  - Highly explosive

- Uses- Cardiopulmonary machines
- Control- Bacillus globigii (earlier known as subtilis)

Plasma sterilization
01:55:15

- Plasma- Fourth state of matter
- Machine used- Sterrad
- Process of producing plasma
  - UV photos → H_2O_2 chemical (>6%)
  - Vacuum, low temperature
- Advantage
  - No toxic residues
  - Short cycle time- 75 mins
- Use- Arthroscope and Ureteroscope
- Control- Bacillus staerothermophilus

Controls
01:57:27

- Hot air oven- Spores of B. atropheus/B. subtilis/C.tetani — FMGE 2021
- Autoclave- Bacillus staerothermophilus
- Plasma sterilization- Bacillus staerothermophilus
- Filtration- Brevendimonas diminuta, Serratia
- Radiation- Bacillus pumilis
- Gas sterilization- Bacillus globigii (earlier known as subtilis)

Testing of disinfectant
01:58:20

- Phenol coefficient test/Rideal walker test
  - Compare disinfectant to phenol
  - Disadvantage- No testing on organic matter
- Chick Martin test/Modified Rideal walker test
  - Testing of disinfectant on organic matter. E.g., Yeast, soil, etc.
- Kelsey and skyes test/Capacity test
  - Testing of disinfectant in increasing microbiological loads
- Kelsey and Maurer test/In use test
  - Practical usage in a hospital

Sporicidal agents
02:01:20

- E- Ethylene oxide
- F-Formaldehyde
- G- Glutaraldehyde
- H- H_2O_2, Hot air oven, 1% Hypochlorite
- A- Autoclave
- P- Per acetic acid
- P- Plasma sterilization
- P- o-phthalic acid
- T- Tyndallisation

Yourwish

Decreasing order of resistance

- Prions
- Cryptosporidium cysts
- Bacterial cysts
- Viruses- Non-envelop > Envelop
  - Envelop has lipid, and when alcohol is used, the lipids are dissolved, thus killing the virus

Spaulding classification

02:04:50

- Critical device
  - Penetrate/enter sterile sites.
    - → E.g. Implants, cardiopulmonary machine, pacemaker, valve
  - High-level disinfection
- Semi-critical device
  - Come in contact with the mucosal membrane.
    - → E.g. Bronchoscope, Laryngoscope, Endoscope
  - High-level disinfection
- Non-critical device
  - Come in contact with skin.
    - → E.g. sphygmomanometer, stethoscope
  - Intermediate/low-level disinfection
- Non-ciritcal surfaces/Medical equipments
  - Computers, desks, tables, chairs
  - Low-level disinfection

PYQs

02:07:00

Q. Which type of microscope can be used to detect the motility of the probable causative organism in a truck driver presenting with painless indurated genital ulcer following unprotected sexual activity?

a. Dark-field microscope
b. Electron microscope
c. Light microscope
d. Fluorescent microscope

Ans: a

Explanation:

- Painless genital ulcer- Syphilis caused by Treponema pallidum (Spirochetes)

Q. Which of the following stains is used for the diagnosis of Mycobacterium tuberculosis infection?

a. Gomori Methenamine silver
b. Perl's Prussian blue
c. Ziehl-Neelsen stain
d. Masson-Fontana stain

Ans: c

Explanation:

- MTB is a acid fast, stained with Ziehl-Neelsen stain

- Gomori Methenamine silver- Fungus
- Perl's Prussian blue- Iron
- Masson-Fontana stain- Melanin

Q. Which of the following methods is used to sterilize a glass petri dish?
a. Autoclaving at 121°C for 30–60 minutes
b. Hot air oven at 160°C for 120 minutes
c. Autoclaving at 134°C for 3 minutes
d. Hot air oven at 121°C for 30–60 minutes

Ans: b

Q. If a sample is cultured in LJ media, what is the likely staining characteristic of the cultured organism?
a. Negative staining
b. Gram negative
c. Acid fast
d. Non-acid fast

Ans: c

Q. Which of the following is gram-negative bacteria cell wall made up of?
a. Lipoproteins, Lipopolysaccharide
b. Peptidoglycan, Lipoproteins, Teichoic acid
c. Lipopolysaccharide, Lipoproteins, Peptidoglycan
d. Teichoic acid, Peptidoglycan

Ans: c

Q. Which of the following organisms cannot be grown on an artificial culture media?
a. Mycobacterium leprae
b. Staphylococcus aureus
c. Mycobacterium tuberculosis
d. Streptococcus pneumoniae

Ans: a

Q. The toughness of bacterial cell walls is due to:
a. Teichoic acid
b. Peptidoglycan
c. Lipopolysaccharides
d. Outer membrane

Ans: b

Q. A 32-year-old laborer working at a construction site presented with fever and hemoptysis. The sputum sample collected for examination showed the following. The smear will be stained by which of the following sequences?

a. Gentian violet – iodine – alcohol – safranin
b. Malachite green – heat – water – safranin
c. Basic fuchsin – tannic acid – methylene blue
d. Carbol fuchsin – acid – methylene blue

Ans: d

Q. What microscopy technique is utilized to generate a high contrast image of transparent, viable bacteria?

a. Phase contrast microscopy
b. Dark field microscopy
c. Electron microscopy
d. Polarized microscopy

Ans: a

Q. Which of the following agents can be used as a disinfectant but not as a sanitizer?

a. Hydrogen peroxide
b. Penicillin
c. Methyl paraben
d. Alcohol

Ans: a

Q. Disposable pipette tips are sterilized by which of the following methods?

a. Autoclave
b. Hot air oven
c. Microwave
d. 70% ethanol

a. a and b only
b. c only
c. c and d only
d. a only

Ans: d

Important Information

- M/c mode of antibiotic resistance- Conjugation
- M/c mode of antibiotic resistance for S.aureus- Transduction
- M/c mode of antibiotic resistance for S.pneumoniae- Transformation
- All scopes are sterilised by CIDEX except Arthroscope and Ureteroscope, which are done by plasma sterilization

2. BACTERIOLOGY PART 1

RULES

00:00:28

• All cocci are gram +ve except: **VeNoM** ○ **V**eillonella ○ **N**eisseria ○ **M**oraxella	• All bacilli are gram-negative except: (**MAC DONALD**) ○ **M**ycobacterium ○ **A**nthracis bacillus ○ **C**lostridium species ○ Corynebacterium **D**iphtheria ○ **N**ocardia ○ **A**ctinomyces ○ **L**isteria ○ **D**iphtheroids

GRAM POSITIVE COCCI

00:01:43

Micrococcus	Feature	Staphylococcus
Tetrad	**Shape**	Bunch of grapes
Oxidative	**Glucose utilization**	Fermentative
+	**Oxidase**	-
+	**Catalase**	+

Staphylococcus Aureus

1. Protein A → Anti-complementary & Anti-phagocytic activity
   - Test → Co-agglutination test
2. Enzymes → Catalase & Coagulase +ve
3. Toxins
   - Hemolysin → α, β, γ, δ
     → β Hemolysin → Sphingomyelinase → Hot-cold phenomenon
   - Panton-Valentine toxin → a/w MRSA
     → γ hemolysin + PV toxin → Synergo-hymenotropic

Clinical Features

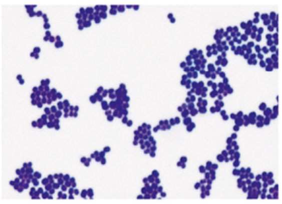
Mnemonic: SOFT PAINS

Skin and Soft Tissue	• SSSS (Staphylococcal Scalded Skin Syndrome/Ritter's Disease) • TEN (Toxic Epidermal Necrolysis). ○ Both are caused by Exfoliative/Epidermolytic Toxin

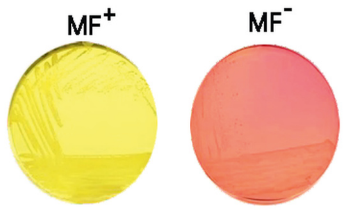
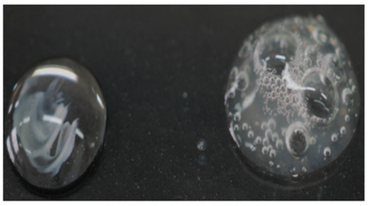
Yourwish

Skin and Soft Tissue 	
Osteomyelitis	• M/c/c of bone infections
Food Poisoning	• Incubation Period (IP): Short, typically 1-6 hours. • Sources: Milk and Meat. • Mediated by Enterotoxins (A-I, Except F), which are Vagomimetic. • D/d → Bacillus cereus → commonly associated with Chinese Fried Rice. **Toxic Shock Syndrome (TSS)** • Usually affects females & are fatal • Mediated by Enterotoxin F • Often associated with the use of retained tampons **Pneumonia** • M/c/c of CAP & VAP **Acute IE** • M/c/c of Native valve endocarditis **Infective arthritis** **Necrotising fasciitis** **Sepsis**

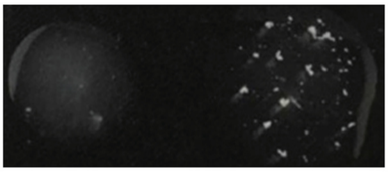
Diagnosis:

Gram staining (GPC) 	• Bunch of grapes
Nutrient Agar 	• Golden pigment ○ D/t Beta-carotene/Staphyloxanthine • Non-diffusible
Blood Agar 	• Narrow zone of hemolysis

Yourwish

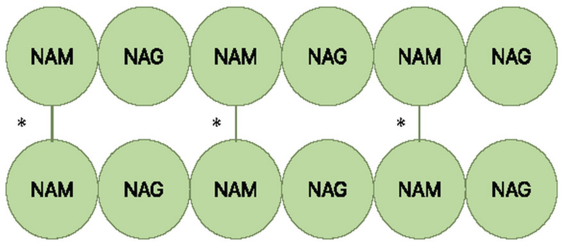
Mannitol Salt Agar 	• Mannitol → Differential • Salt → Selective • Phenol red → Indicator • Mannitol fermented → Yellow colour
Catalase test  CATALASE TEST	• Formation of bubbles → +ve **Organisms showing Catalase +ve** (CATs SPACE BEING MADE) • S - S. aureus, serratia (red) • P - Pseudomonas (blue green) • A - Aspergillus • C - Candida, cryptococcus • E - E.coli, Enterobacteriaceae • BeiNG → B. anthracis, Neisseria • Made → MTB, Micrococcus

Coagulase test

Slide coagulase	Feature	Tube coagulase
 Negative Positive		 Negative Positive
• Bound coagulase	**Aka**	• Free coagulase
• Staph Aureus • Staph Lugdunensis	**Positive in**	• Staph Aureus • Staph Schleiferi
• Clumping factor		• Coagulase-reacting factor

Treatment:

- **DOC** → Penicillin/β-Lactam
  - MOA → Transpeptidase
  - Resistance by β-lactamase production made by BLA gene & Plasmin coded
  - Transfer of resistance → Transduction > Conjugation
- Penicillin resistant → Methicillin given
  - Methicillin → resistance by the MecA gene → (PBP → PBP2a)
  - Diagnosis of methicillin resistance:
    - → Cefoxitin disc diffusion agar / Oxacillin
    - → Latex agglutination test
    - → ELISA for MecA
    - → PCR for MecA
- Methicillin resistance → Vancomycin



- Vancomycin resistance → VAN gene → VISA & VRSA
  → VISA → MIC 4-8 μg/ml
  → VRSA → MIC ≥16 μg/ml

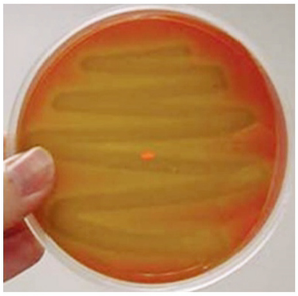
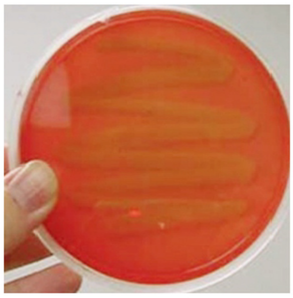
Cons - Coagulase Negative Staphylococcus Aureus

FMGE 2024, 2025

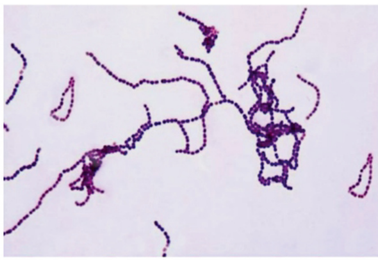
STAPHYLOCOCCUS EPIDERMIDIS	FEATURE	STAPHYLOCOCCUS SAPROPHYTICUS
More common	Common	Less common
Prosthetic heart valve endocarditis	Causes	UTI
Sensitive	Novobiocin	
Biofilm formation → Polysaccharide Resistant to Antibiotics		

Streptococcaceae

NEET PG 2025, FMGE 2023 00:21:52

ALPHA HEMOLYSIS	BETA HEMOLYSIS	GAMMA HEMOLYSIS
		
Green colour	Yellow colour	No colour change
• S. viridans • S. pneumoniae	• Classification → Lancefield ○ Based on C Ag → Divided into Group A-V → Group I, J not included • Group A → S. pyogenes ○ Classified according to the M protein → Griffith typing • Group B → S. agalactiae	

Alpha Hemolytic Streptococci

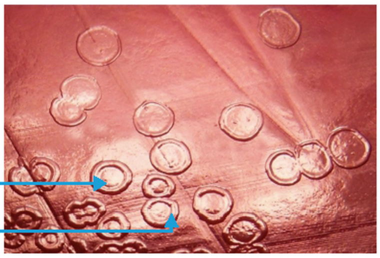
STREPTOCOCCUS VIRIDANS	FEATURES	STREPTOCOCCUS PNEUMONIAE
	**Arrangement**	Lanceolate shaped 

Insoluble	**Bile solubility**	Soluble
Insensitive	**Optochin sensitivity**	Sensitive
Not seen	**Inulin fermentation**	Seen

- Streptococcus Viridans Include
  - S. mitis
  - S. mutans → cause dental caries
  - S. sanguis → late prosthetic heart valve endocarditis
  - S. salivarius- capsule and slime layer

Pneumococcus / Streptococcus Pneumoniae:

NEET PG 2021, INICET 2022



- Capsular polysaccharide
  - >90 serotypes
  - Quellung reaction (Swelling)
- Clinical features:
  - Community acquired Pneumonia (M/c/c)
  - Otitis media
  - Sinusitis
  - Meningitis
- Diagnosis:
  - M/E → Lanceolate shaped
  - Culture → Draughtsmann/Carrom coin colonies
    → D/t Autolysin/Amidase
- Treatment → Beta-lactams

INICET 2022

- Prevention:
  - Pneumovax → 23-valent PPV polysaccharide vaccine
    → Not given to <2 years
  - Prevnar → 13 valent
    → Below 2 years

Beta Hemolytic Streptococci

Streptococcus Pyogenes (GABHS)

00:30:40

- Virulence factors
  - Enzymes and Toxin:
    → Streptokinase
    → Hyaluronidase
    → DNAase- A, B, C, D
    → Hemolysin/ Streptolysin

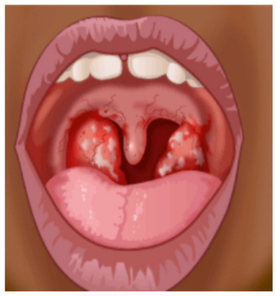
Important Information

Anti-DNAase B Antibody testing is done for Pyoderma PSGN

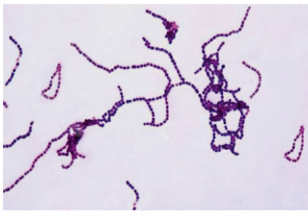
SL-O	Feature	SL-S
Labile	**O2 & Heat**	Stable
ASO Antibody	**Antibody**	-
Antigenic	**Property**	Non-Antigenic
Deeper	**Hemolysis**	On surface

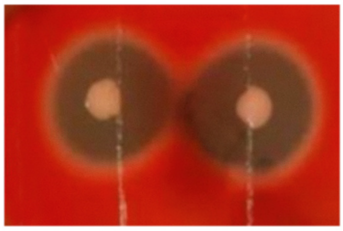
- SPE (Streptococcal pyrogenic exotoxin) A, B, C
  - → Scarlet fever
  - → PSGN
- Clinical features:
  - Suppurative
    - → **N** - Necrotising fasciitis
    - → **I** - Impetigo
    - → **P** - Pharyngitis, pneumonia
    - → Pain, Tender cervical LAP (Rx → Penicillin)
    - → **L** - Lymphangitis
    - → **E** - Erysipelas
    - → **S** - Scarlet fever → Strawberry tongue
  - Non-suppurative
    - → RHD, PSGN
    - → PANDAS: Neuropsychiatric disorder caused by streptococcus (a/w OCD)

NEET PG 2022



- Diagnosis:
  - M/E → GPC in chains
    - → GPC in chains causing PVE → S. viridans
  - Blood Agar → Pinpoint colonies with a wide zone of hemolysis
  - Transport media → Pike's media
  - Selective media:
    - → PNF
    - → CVBA (Crystal Violet Blood Agar)
    - → Liquid media- granular turbidity
  - Biochemical test
    - → PYR test positive
    - → Bacitracin sensitive



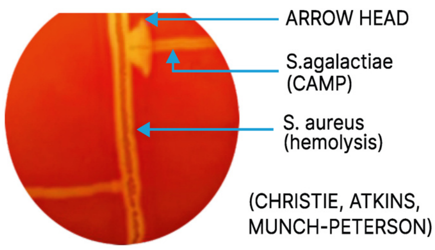


Gbs- Streptococcus Agalactiae

00:38:05

INICET 2024, FMGE 2023

- Affects children and neonates more
  - Meningitis
  - Pneumonia
  - Septicemia
- Laboratory diagnosis:
  - CAMP test positive
  - Hippurate hydrolysis positive
  - Bacitracin resistant
  - Red pigment on Islam media



CAMP TEST+in
S. AGALACTIAE (Group B)

Gamma hemolytic streptococci

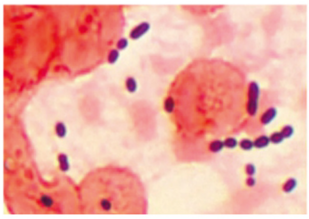
Enterococcus

00:40:45

- Organism
  - Enterococcus faecalis – most common
  - Enterocccus faecium

INICET 2024

- Features
  - E: Spectacle-shaped
  - N: Non-motile & Non-hemolytic
  - N: Non-sporing
  - N: NaCL 6.5%
  - T: Heat-tolerant
  - E: Bile 40%
    → Bile esculin azide agar → Black colonies
  - R: PYR test +ve
  - U: UTI
  - S: Septicemia
- **Treatment:**
  - Penicillin → Resistant → Vancomycin → Resistant → Linezolid



Positive Negative
BEA Agar: Turns black d/t aesculin hydrolysis

Important Information

Vancomycin Resistance - Mechanism

- Van A gene → Converts D-ALA-D-ALA to D-ALA-D-Lactate/Serine

GRAM NEGATIVE COCCI

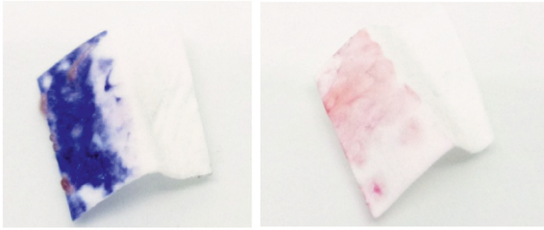
00:44:55

NEET PG 2021, 2024, 2025
INICET 2024, 2025

Neisseria

FEATURE	NEISSERIA MENINGITIDIS	NEISSERIA GONORRHOEAE
Habitat	Nasopharynx	STD (Genitourinary tract)
Fermentation	Maltose + Glucose	Glucose
Shape	Lens-shaped, Capsule	Kidney-shaped
Catalase	Positive (+)	Positive (+)
Oxidase	Positive (+)	Positive (+)
Virulence	Capsular polysaccharide (A, B, C, Y, W135)	-
Vaccine	Protection against all except B	-
Outer Membrane Proteins	OMP	OMP, Protein I (PORB1a & PORB1b), Protein II
DGI Association	-	PORB1a is associated with DGI
Enzymes	IgA protease	IgA protease
Toxins	Endotoxin (G-ve)	Endotoxin (G-ve)
Twitching motility	Type IV Pili	Type IV Pili
Transport media	Amies/Stuart media	
Culture media	Modified Thayer Martin media (Vancomycin, Colistin, Nystatin, trimethoprim)	
Treatment	IV Ceftriaxone	Ceftriaxone + Azithromycin

Positive Negative



Oxidase Test

Neisseria meningitidis

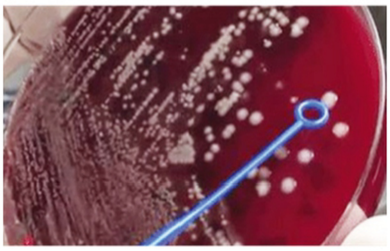
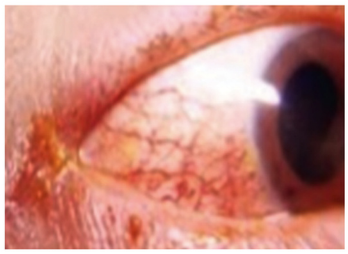
FMGE 2021

Clinical features:
- Pyogenic meningitis
- B/L adrenal haemorrhage (Waterhouse Friderichsen Sx)

Neisseria gonorrhoeae

Clinical features:
- Ophthalmia neonatorum
- Urethritis, Cervicitis, Watercan perineum (multiple discharging sinuses)
- **Complications:**
  - FITZ Hugh Curtis Syndrome (Also seen with C.trachomatis)
    → Perihepatitis
    → USG → Violin string
  - DGI

Moraxella

MORAXELLA CATARRHALIS	MORAXELLA LACUNATA
• Otitis media • COPD exacerbation (2nd M/c/c in COPD) ○ M/c/c → H.influenza	• Angular conjunctivitis
 Hockey puck sign	

GRAM POSITIVE BACILLI

Corynebacterium Diphtheria (Kleb Loeffler Bacillus)

00:53:55

INICET 2021, 2023, 2024
FMGE 2021, 2024, 2025

Forms of Diphtheria

- Respiratory or Faucial Diphtheria
  - Bull Neck (Associated with Lymphadenopathy)
- Pseudo-membrane: Characterised by bleeding upon peeling
  - 2 Swabs taken below the membrane
- Cutaneous → Ulcer
- Systemic → CNS, PNS, CVS (Myocarditis → Tabby cat/Tigered heart Appearance)

Toxins

- Mechanism of DT: It decreases the protein Synthesis (By ADP ribosylation of EF-2)
- DT
  - Dependent on iron (Inversely proportional to iron levels)
  - DT → Acidic pH/Formalin → Toxoid (vaccine)

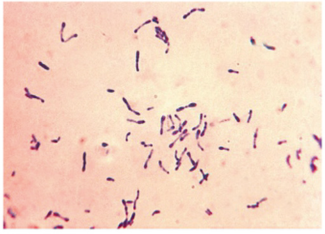
Important Information

Organisms causing ↓ protein synthesis

- Diphtheria (ADP ribosylation of Ef2)
- Exotoxin A of Pseudomonas (ADP ribosylation of Ef2)
- Shiga toxin (↓ 60s Ribosome function)
- Shiga-like toxin/ Verocytotoxin (↓ 60s Ribosome function)

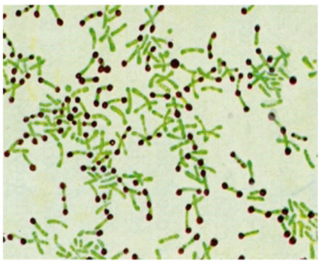
Microscopic examination:

- Chinese letter/Cuneiform pattern (d/t snapping division)



Albert stain:

- Volutin granules/Bipolar granules/Metachromatic granules/Babes Ernst granules
  - Composition → Polymetaphosphate
- Composition:
  - Toluidene blue
  - Iodine
  - Malachite green
- Stain for granules
  - Ponder
  - Loeffler methylene blue (Best)
  - Albert
  - Neisser



Enriched Media

- Loeffler serum slope
- Time to grow → 6-8 hours → Early diagnosis

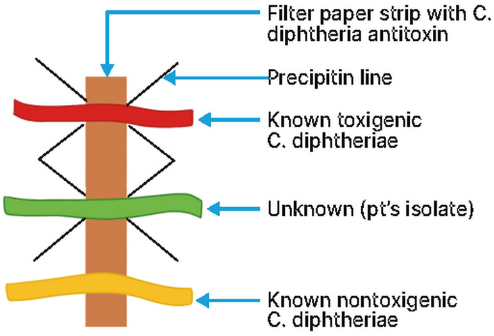
Yourwish

Selective Media (Best)
- Potassium Tellurite Agar
- Tinsdale Agar

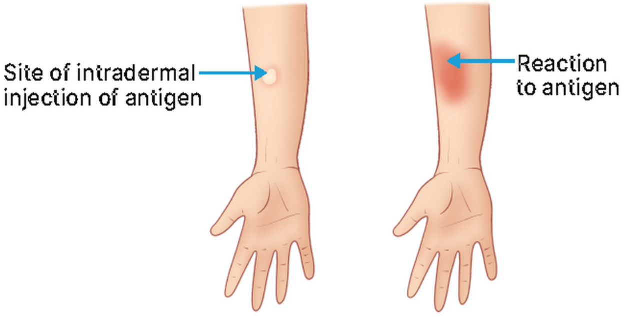
Elek's Gel Precipitation

INICET 2024

- For Toxigenicity
- Double diffusion in two dimensions



Schick Test
- For Susceptibility



S: Susceptible
P: Positive
I: Immune
N: Negative

Management:

Type of disease	Anti DT	Antibiotics	Adjunctive
Pharyngeal/ laryngeal	20,000-40,000 IM or IV	Penicillin or erythromycin	Droplet precaution
Nasopharyngeal disease	40,000-60,000 IM or IV	Penicillin or erythromycin	Droplet precaution
Extensive disease	80,000-1,20,000 IM or IV	Penicillin or erythromycin	Droplet precaution
With neck disease/ disease >3 days	Half dose IM Half dose IV	Penicillin or erythromycin	Droplet precaution

Bio-Typing Of Corynebacterium

C. gravis	C. intermedius	C. mitis
• Daisy head appearance • Starch fermentation	• Frog egg appearance • Non-hemolytic	• Poached egg appearance • Least virulent

- C. ulcerans: Ulcer; Involves lungs
- C. pseudo TB: Preisz-Nocard bacillus; affects sheep
- C. minutissimum: Erythrasma (Coral red on wood lamp)

Lipophilic:
- C. jeikeium: Prosthetic valve endocarditis
- C. urealyticum: Struvite stones (also associated with Proteus)

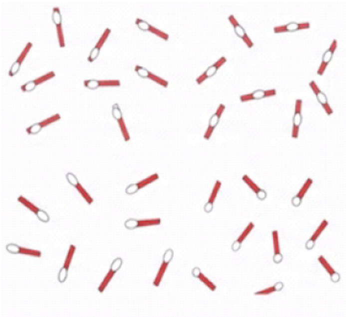
Spore-Forming Organisms

01:07:41

Bacillus	Clostridium
Non-Bulging spores	Bulging spores
Obligate aerobes	Obligate anaerobes

Types of spores:

- Subterminal → M/c
- Terminal
  - C. Tetani → Drum stick appearance
  - C. Tertium → Tennis racket appearance
- Central
  - B. Cereus
  - C. Bifermentans



Bacillus Anthracis

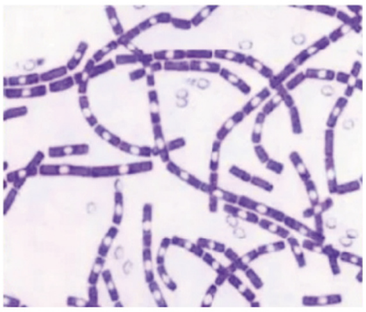
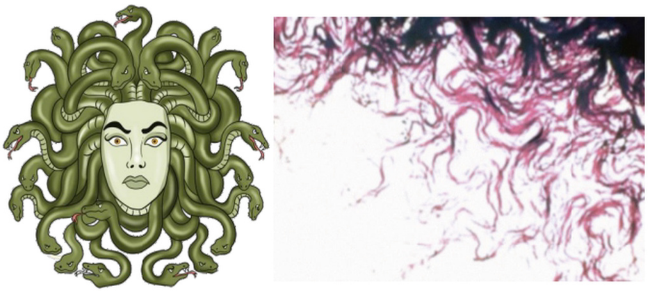
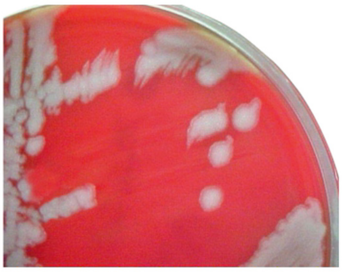
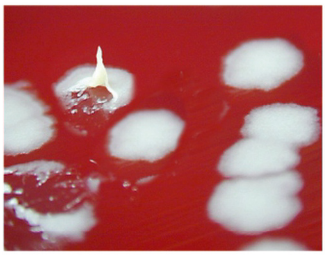
FMGE 2024
NEET PG 2025

- Category A Bioterrorism agent
- Virulence factors:
  - Capsule
    - → All capsules → Polysaccharides
    - → B.Anthracis → Polypeptide/Polyglutamate
      - Polypeptide capsule → Polychrome methylene blue stain (McFadyean reaction)
- Anthrax toxin
  - Tripartite:
    - → Edema factor → Increases cAMP
    - → Protective factor → Attachment
    - → Lethal factor → Death

Anthrax

- Hide Porters disease: Cutaneous anthrax
  - Malignant pustule: eschar (black)
- Wool sorter's disease: Pulmonary anthrax
  - Haemorrhagic Mediastinitis: M/c associated with Bioterrorism
- Intestinal anthrax
  - Haemorrhagic enteritis → d/t undercooked meat

Identification:

• Gram stain → G+ve bacilli ○ Bamboo stick/Box-car appearance	
Findings on an Agar	
 Medussa head appearance	 Frosted glass appearance
 Comet tail appearance	 Beaten egg appearance
 **Penicillin Agar** → String of pearls	 **Gelatin stab** → Inverted fir tree

- Selective media → PLET media
- Serology → Ascoli's ring thermos precipitin

Important Information

Fir tree → C.tetani

Napiform/Turnip → V.cholera

Treatment:

- Uncomplicated cutaneous: Ciprofloxacin or Doxycycline (7-10 days)
- Systemic: Ciprofloxacin / Doxycycline + Raxibacumab
- Anthrax meningitis: 60-day antibiotic (Ciprofloxacin + Meropenem + Clindamycin)
- PEP (Post-exposure prophylaxis): AVA Biothrax + 60-day antibiotic

Bacillus Cereus

FMGE 2022

EMETIC TYPE	FEATURE	DIARRHEAL TYPE
1-5 hours	IP	8-16 hours
Chinese fried rice	Food	Meat and milk
Increased CGMP	MOA	Increase CAMP

Selective Media

- **MYPA** → Mannitol, yolk, polymyxin, agar
- **PEMBA** → Polymyxin, mannitol, bromothymol blue

Clostridium

01:18:33

- Mostly Unencapsulated (Except → C.perfringens)
- All motile (Except → C. perfringens & C. tetani VI)

C. Perfringens/Welchii

FMGE 2023

- M/c to cause gas gangrene,

Important Information

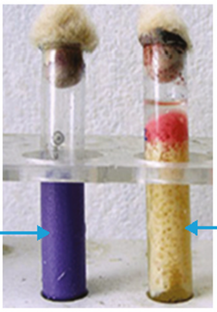
Other organism causing gas gangrene

- C.perfringens
- C.septicum (Citron bodies)
- C.novyi

  - Gas bubbles (crepitus) are seen
  - Rx for gas gangrene:
    → Surgical debridement
    → IV Penicillin + Clindamycin for 10-14 days
    → Hyperbaric oxygen
- Food poisoning → Necrotising enteritis
  - PIGBEL → Pork and Sweet Potatoes
    → Rx → IV Penicillin + Metronidazole

Lab diagnosis:

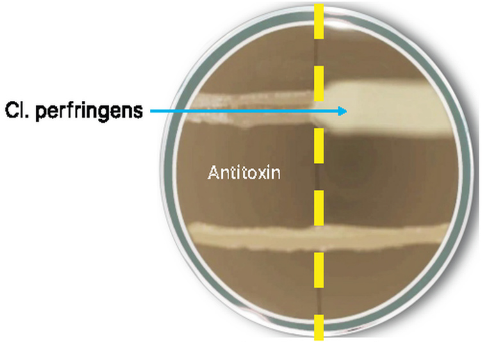
Stormy clot formation on the litmus milk test



Litmus milk test with 'stormy clot reaction'

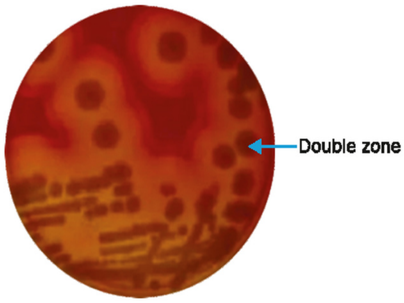
Yourwish

Naegler Reaction → Egg yolk agar
- Egg yolk → Lecithin
- C. perfringens → -toxin → Lecithinase
  - Causes Opacity



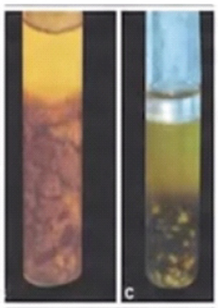
Nagler Reaction

Target hemolysis
- Inner ring → -toxin
- Outer ring → -toxin

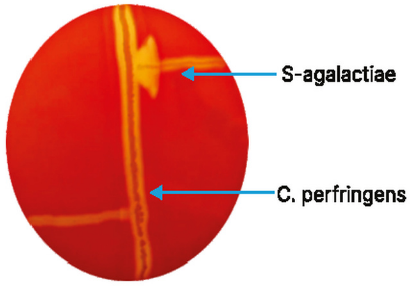


Target Hemolysis

RCMB → Robertson cooked meat broth
- Saccharolytic → Red



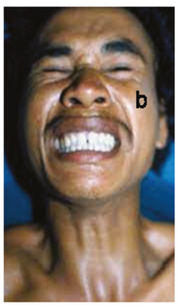
Reverse CAMP test +



Reverse CAMP test

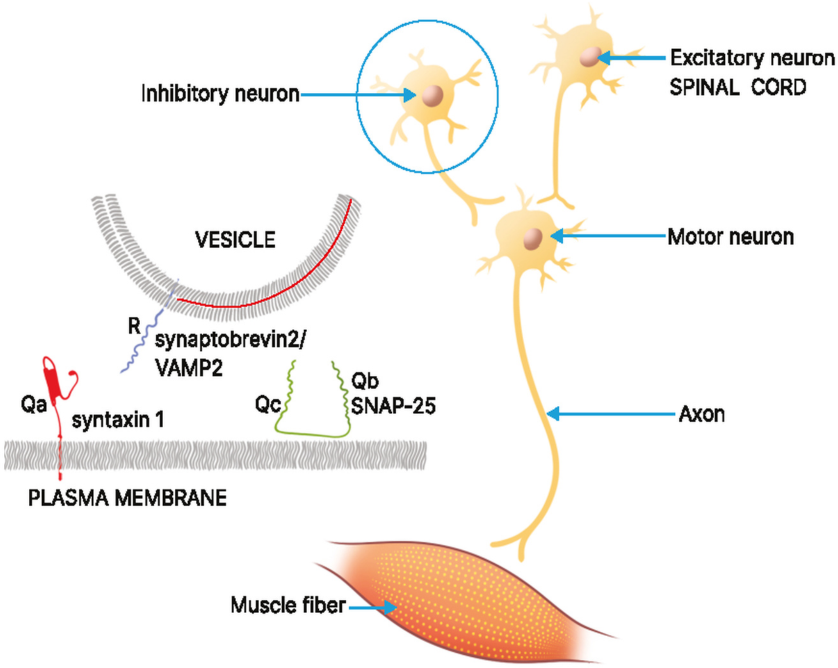
C. TETANI

- First muscle → Masseter → Trismus
- Complications:
  - Risus sardonicus
  - Opisthotonus position
- Toxins:
  - Tetanospasmin → O2 stable
  - Tetanolysin → O2 labile
- Toxins act pre-synaptically and (-) SNARE proteins
  - ↓ Release of inhibitory neurotransmitter → Contraction



Important Information

- Strychnine poisoning → Toxins act post-synaptically



Diagnosis:

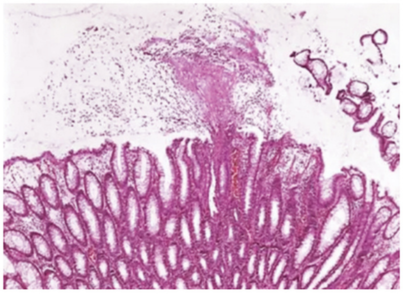
 Terminal Spores	 Proteolytic Reaction	 Swarming
Gram staining → Terminal drumstick spores	**RCMB** → Proteolytic reaction (Black)	**Agar** → Swarming motility

- **Gelatin stab** → fir tree

Clostridium Botulism

- Food-borne botulism: Bottled & Canned food
- Features → Diplopia, Dysphagia, Dysarthria, Descending flaccid paralysis, Dilated pupils
- Wound botulism
- Infant botulism → Honey
  - The first symptom is constipation
  - Floppy Baby syndrome
- Iatrogenic botulism

C. DIFFICILE



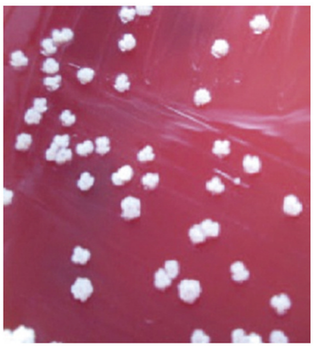
- Pseudomembranous enterocolitis
  - M/E → Volcano-like eruption
- R/F: Long-term use of antibiotics
- C/F: Watery diarrhoea
- Toxins
  - Toxin A: Enterotoxin (attachment to gut)
  - Toxin B: Cytotoxin
  - Toxin → Detected by ELISA
- Media
  - CCFA: Cefoxitin cycloserine fructose agar
  - CCYA: Cefoxitin cysteine yeast extract agar
- Treatment:
  - Vancomycin,
  - Milder cases → Fidaxomycin

Filamentous organisms

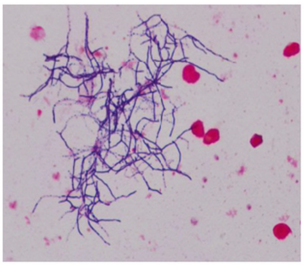
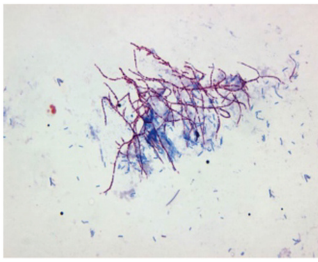
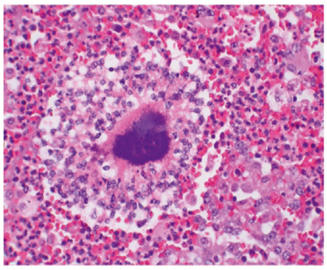
Nocardia and actinomycetes

INICET 2022, 2023, 2024

01:33:00

NOCARDIA	ACTINOMYCETES
Strict aerobe	Strict anaerobe
1% acid fast	Non-acid-fast
Soil (exogenous)	Mouth (endogenous flora) 
M/c Pulmonary (LAP Absent)	M/c Jaw
M/c Extra- Pulmonary: Brain	Oral cervical actinomycosis triad
Culture: Paraffin bait technique	Molar tooth on solid media 

Yourwish

 	 • Sunray appearance • Splendore-hoepplei phenomena
Rx: Sulfonamides	Rx: Penicillin

A.Israeli:

- Yellow grains (can be Zn stain positive)
- Associated with → PID, IUCD

Listeria

01:37:46

- Tumbling motility → Motile at 22-25°C & Non-motile at 37°C → Differential motility
- A: Animal test → Anton test
- B: β-Hemolysis
- C: Cheese (Refrigerated things)
  - Cold enrichment (at 4°C)
  - CAMP+ (S. agalactiae and Listeria)
  - Catalase +
- D: Diarrhoea
- E: ELISA
- F: Flagella (Peritrichous)
- G: Gravid female → Granulomatous infantisepticum

Treatment → Gentamycin + Ampicillin

Mycobacteria

01:40:39

Mtb/koch's bacillus

- Mycolic acid - acid fastness
- Virulence factor → Cord factor
- LAM → Lipo Arabino Mannan → Inhibit phagocytosis
  - LAM Assay → Done in urine in HIV+ individuals
- M/c → Pulmonary TB (Extrapulmonary → LN)

Foci:

- Ghon foci: Lung
- Ghon complex: Lung + L.N (Lymph Node)
- Ranke complex: Calcification of the Ghon complex
- In the lung:
  - Apex: Simon focus
  - Supraclavicular: Puhl's focus
  - Infraclavicular: Assmann focus

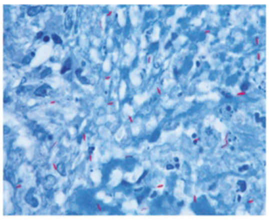
Yourwish

- Liver: Simmond focus
- Blood vessels: Weigert's focus (Pulmonary vein)
    - Pulmonary artery → Rasmussen aneurysm
- Brain: Rich's focus

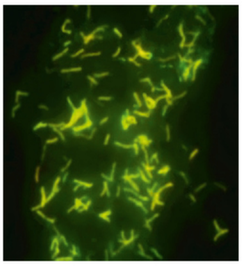
Sputum Sample

- Concentration → Modified Petroff method: Further modification
    - 2% NaOH + NALC (N-Acetyl L Cysteine)

Microscopy



- Zn stain → 20-25% H2S04
    - Sensitivity: 10^4 AFB/mL
- Fluorescent stain



- Auramine & rhodamine stain

Culture

- Lowenstein Jensen medium → Rough, Buff, Tough colonies are seen
- Components
    - Coagulated hen's egg
    - Mineral salt solution
    - Asparagine
    - Malachite green
- Time → 6-8 weeks
- Sensitivity → 10-100 AFB/ml

M. TUBERCULOSIS VS M. BOVIS:

INICET 2024
FMGE 2021, 2023, 2024

	M. Tuberculosis	M. Bovis
Niacin	+	-
Nitrate reduction	+	-
Catalase	+	-
Colony	Rough/ Buff/ Tough	Smooth/ White/ Break easily

Newer Automated Methods

- Bactec MGIT - Mycobacterium Growth Indicator Tube

  - Fluorescent based
  - Uses Middlebrook 7H9 broth (Liquid media)
- BacT/ alert → Colourimetry-based
- Versatrek → Detects pressure changes

Typing Methods

- Gene xpert
  - CBNAAT → Cartridge-Based Nucleic Acid Amplification Test
  - TAT → 2 Hours
  - Sensitivity → 131 Organisms/ml
  - Use → Diagnosis of TB & Rifampicin resistance
- RFLP IS6110 → Target sequence/ strain
- Line probe assay

Diagnosis of Latent Tb

Tuberculin test/ Mantoux test 	• Type IV HS reaction (CMI)
	• 0.1ml of PPD I.D → 48-72 Hours → Induration
	  ○ >10 mm → + ve
	  ○ 5-9 mm → Equivocal
	  ○ <5 mm → - ve
	• Interpretation
	  ○ Positive → Present or past infection
	  ○ False +ve → BCG vaccination, non-TB mycobacterium
	  ○ False negative → HIV/ immunodeficiency

IGRA (Interferon Gamma Release Assay)	• **Quantiferon Gold** • Sample → Blood sample → T cells (Lymphocytes) T cell of suspected individual ↓ Exposed to CFP 10, TB 7.7, ESAT 6 (TB Ag) ↓ Release of Interferon gamma ↓ Measured by ELISA

Non tuberculous mycobacteria

Runyon's classification

- Photochromogens → Pigment production in light
- Scotochromogens → Pigment production in light & dark
- Non photochromogens → No Pigment production
- Rapid growers → Growth (<1 week) in LJ media

PHOTOCHROMOGENS	• M. marinum → swimming pool/ fish tank granuloma (warty skin lesion) • M. asiaticum • M. simiae • M. kansasii
SCOTOCHROMOGENS	• M. szulgai • M. scrofulaceum → scrofula • M. gordonae → tap water scotochromogen

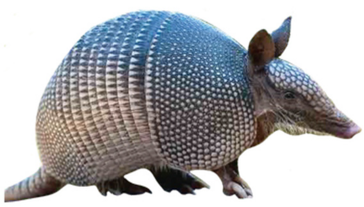
NON PHOTOCHROMOGENS	• M. avium
	• M. intracellulare (battey bacillus)
	  ○ M.avium + M. intracellularae → Mycobacterium avium complex
	    → Responsible for Lady Windermere syndrome
	• M. ulcerans - causes Buruli ulcer
	• M. xenopi
	• M. indicus pranii → MW vaccine (Immunomodulator vaccine)

RAPID GROWERS (< 7 DAYS)	H/o post-surgery abscess • M. fortuitum • M. smegmatis • M. chelonae • M. Phlei

Mycobacterium Leprae/ Hansen's Bacillus

FMGE 2022

- Obligate intracellular
- Grown in Nine-banded armadillo/Foot pad of mice



PYQs

02:03:29

Q. Group A Streptococcus is the most common cause of bacterial pharyngitis in school-aged children. Which of the following bacterial components is primarily responsible for its attachment to fibronectin on the epithelial lining of the pharynx? NEET PG 2025

a. Lipoprotein
b. Lipoteichoic acid
c. Capsule

d. Flagella

Answer: b. Lipoteichoic acid

Q. What is the most likely diagnosis for a 9-year-old boy who presents with hematuria, hypertension, facial puffiness for 3 days, and a recent history of throat infection two weeks ago, with urine examination showing albumin positivity? FMGE July 2023

a. Group B beta-hemolytic streptococci
b. Staphylococcus aureus
c. Group A beta-hemolytic streptococci
d. Staphylococcus epidermidis

Answer: c. Group A beta-hemolytic streptococci

Q. A 10-year-old child presents to the pediatric clinic with complaints of joint pain, swelling, and difficulty walking. On examination, the child is found to have a tender, swollen knee joint and a history of recent sore throat. Laboratory investigations reveal elevated antistreptolysin O (ASO) titers. A renal biopsy is performed, and it shows glomerular changes consistent with PSGN. Which of the following organisms is most likely responsible for both the acute rheumatic fever and PSGN in this patient? FMGE July 2023

a. Streptococcus pneumoniae
b. Streptococcus pyogenes
c. Streptococcus agalactiae
d. Streptococcus mutans

Answer: b. Streptococcus pyogenes

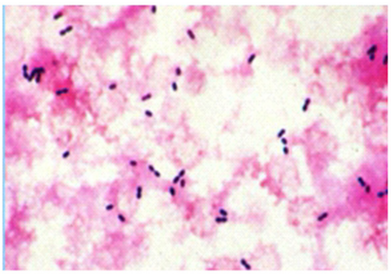
Q. An 8-year-old boy presented with dark-coloured urine, oliguria, hypertension, and facial puffiness for 3 days. The urine test is positive for albumin. He had a history of throat infection 2 weeks back. On microscopic examination, enlarged, pale glomeruli and epithelial humps are seen. Which of the following is the most likely diagnosis?

a. Post-staphylococcal glomerulonephritis
b. Post-streptococcal glomerulonephritis
c. Nephrotic syndrome
d. IgA nephropathy

Answer: b. Post-streptococcal glomerulonephritis

Q. A patient presented with meningitis, and the CSF sample was subjected to Gram staining, which appeared in the microscopic image below. Which of the following is true of the organism? INI CET Nov 2021

a. α-hemolytic and lanceolate-shaped
b. β-hemolytic and lanceolate-shaped
c. No capsule
d. Oxidase and catalase positive



Answer: a. α-hemolytic and lanceolate-shaped

Yourwish

Q. Which among the given is a Gram-positive cocci in chains causing necrotising fasciitis? INICET Nov 2024

a. Nocardia
b. Streptococcus
c. Enterococcus
d. Micrococcus

Answer: b. Streptococcus

Q. A neonate admitted with the features of meningitis. Bacteria isolated from CSF are bacitracin-resistant. Neonatal meningitis is caused by which organism? FMGE July 2023

a. Pneumococcus
b. Streptococcus pyogenes
c. Streptococcus agalactiae
d. Meningococci

Answer: c. Streptococcus agalactiae

Q. A 10-year-old child with AIDS presented with a fever and productive cough. On auscultation, bronchial breath sounds and crepitations were heard in the right infra-scapular region. Chest x-ray showed right lower lobe consolidation. The CD4 count was 55 cells/mm3. What is the most common causative organism for this condition?

a. Pneumocystis jirovecii
b. Streptococcus pneumonia
c. Staphylococcus aureus
d. Mycoplasma

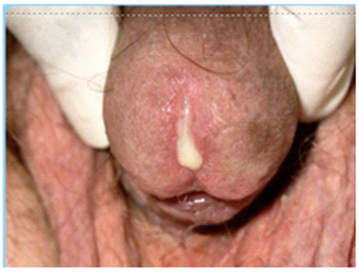
Answer: b. Streptococcus pneumonia

Q. A patient with a history of penicillin allergy has been diagnosed with Enterococcus infective endocarditis. Which of the following antibiotics is the most appropriate treatment option? INICET May 2024

a. Vancomycin
b. Ceftriaxone
c. Piperacillin
d. Aztreonam

Answer: a. Vancomycin

Q. One week after having unprotected sexual intercourse, a 25-year-old male develops urethral discharge as shown in the image below. What is the most likely causative organism for this condition? NEET PG 2021



a. Neisseria gonorrhoeae
b. Ureplasma urealyticum
c. Herpes simplex virus
d. Trichomonas vaginalis

Answer: a. Neisseria gonorrhoeae

Q. A patient from a military background presents with fever, a rash, and neck rigidity. Laboratory investigations reveal a lack of the membrane-attacking complex. What is the most likely causative agent? NEET PG Aug 2024

a. Neisseria meningitidis
b. Neisseria gonorrhoea
c. Klebsiella
d. CMV

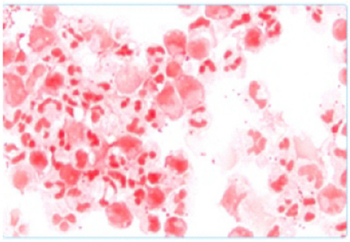
Answer: a. Neisseria meningitidis

Q. A female patient presents with swollen Bartholin glands. Discharging pus showed Gram-negative intracellular diplococci. Which is the organism? INICET May 2024

a. Neisseria gonorrhoeae
b. Chlamydia
c. Chancroid
d. Syphilis

Answer: a. Neisseria gonorrhoeae

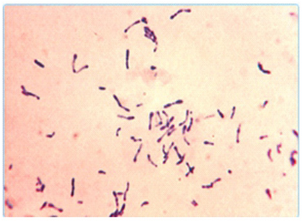
Q. A 12-year-old girl presents with a severe headache, photophobia, and a high fever of 101°F. On examination, papilledema and nuchal rigidity were present. Kernig's and Brudzinski's signs were positive. CSF examination shows reduced glucose, increased protein, and increased leukocytes with a predominance of neutrophils. Gram staining of the CSF is shown below. The causative organism is: FMGE June 2021



a. Haemophilus influenzae type B
b. Neisseria meningitidis
c. Streptococcus pneumoniae
d. Listeria monocytogenes

Answer: b. Neisseria meningitidis

Q. A 6-year-old boy complains of cough and throat pain. On oral examination, a white pseudomembrane is observed. A swab from the lesion was collected and stained, as shown in the image below. What is the most likely causative organism? INICET July 2021



a. Corynebacterium diphtheriae
b. Streptococcus pyogenes
c. Staphylococcus aureus
d. Haemophilus influenzae

Answer: a. Corynebacterium diphtheriae

Q. What is the causative organism of bull neck? FMGE June 2021

a. Corynebacterium diphtheriae
b. Corynebacterium jeikeium
c. Corynebacterium minutissimum
d. Corynebacterium urealyticum

Answer: a. Corynebacterium diphtheriae

Q. What is the most probable condition for a 6-year-old child who has not received immunisation, presented to the Emergency Room by a concerned mother, experiencing symptoms such as fever, cough, and difficulty breathing? Physical examination reveals the presence of a pseudomembrane on the tonsils that bleeds upon attempted removal, as well as a swollen neck giving a bull-neck appearance. FMGE June 2021

a. Infectious mononucleosis
b. Tonsillitis
c. Diphtheria
d. Candidiasis

Answer: C. Diphtheria

Q. Which of the following is the mechanism of action of diphtheria toxin? FMGE Jan 2024

a. ADP phosphorylation of EF-2 - Decreasing protein synthesis
b. Increasing cAMP
c. Increasing cGMP
d. Decreasing 60s ribosome

Answer: **a.** ADP phosphorylation of EF-2 - Decreasing protein synthesis

Q. A farmer presents with a lesion on his arm after working with cattle on his farm. Gram staining of a sample from the lesion reveals gram-positive rods with square ends and central spores. What is the most likely organism causing this lesion? FMGE June 2024

a. Brucella abortus
b. Pseudomonas aeruginosa
c. Bacillus anthracis
d. Bacillus cereus

Answer: **c.** Bacillus anthracis

Q. A farmer presents with an ulcerative skin lesion showing signs of necrosis. Smear from the ulcer stained with polychrome methylene blue reveals capsulated bacilli that are McFadyean reaction positive. What is the most likely causative organism? NEET PG 2025

a. Clostridium perfringens
b. Bacillus anthracis
c. Yersinia pestis
d. Francisella tularensis

Answer: **b.** Bacillus anthracis

Q. A patient presented with vomiting to the medicine OPD. He mentions eating fried rice recently. What is the most likely causative organism? FMGE June 2022

a. Clostridium perfringens
b. Bacillus cereus
c. Staphylococcus aureus
d. Bacillus anthracis

Answer: **b.** Bacillus cereus

Q. A soldier arrives at a referral hospital 24 hours after experiencing a shrapnel injury to his right thigh caused by a high-speed projectile. He expresses significant discomfort at the site of the wound. Upon examination, there is evidence of crepitus. Which of the following microorganisms is the probable culprit behind his current state?

a. Clostridium septicum FMGE Jan 2023

b. Clostridium difficile

c. Clostridium novyi

d. Clostridium perfringens

Answer: **d.** Clostridium perfringens

Yourwish

1. BACTERIOLOGY PART 2

GRAM NEGATIVE BACILLI

00.00.16

- Family → Enterobacteriaceae

CLASSIFICATION

- Based on fermentation of lactose
  - Lactose fermentor
  - Non - Lactose fermentor
  - Late lactose fermentor
- 3 media
  - MacConkey agar
  - CLED
  - EMB

MACCONKEY AGAR

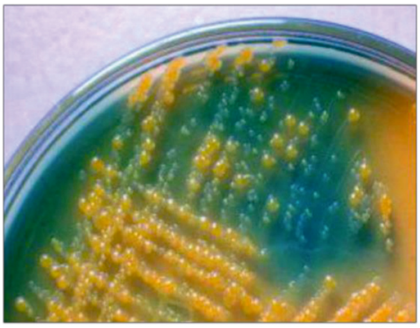
FMGE 2021

- Differential, Indicator, and Selective media
- Composition
  - Peptone
  - Lactose
  - Agar
  - Neutral red → Indicator dye
  - Taurocholate (Bile salts) → Selective media
- Lactose fermentors → Pink color

MacConkey Agar

CLED

- Cysteine lactose electrolyte-deficient
- Indicator → Bromothymol Blue (BTB)
- Lactose fermentors → Yellow
- CLED is better than MacConkey agar because it detects gram-positive, gram-negative, and fungus



CLED

EOSIN METHYLENE BLUE (EMB)

- Lactose fermentors → Blue or black with a green halo around it

EMB

Lactose fermentor	Non - Lactose fermentor	Late lactose fermentor
• E.coli • Klebsiella • Citrobacter • Enterobacter	• Salmonella • Shigella • Yersinia • Proteus	• Shigelli sonnei

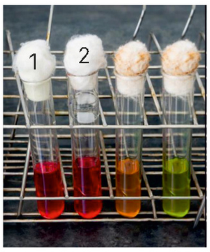
- Based on motility
  - Motile
  - Non-motile

Motile organism	Non - motile organism
• E.coli • Enterobacter • Citrobacter • Most Salmonella • Proteus • Yersinia	• Klebsiella • Shigella • Salmonella pullorum • Salmonella gallinarum

- Based on urease positivity
  - Urease positive → Pink-red color

Urease positive	Urease negative
• Klebsiella • Proteus	• E.coli • Enterobacter • Citrobacter • Shigella • Salmonella • Yersinia
Other organisms showing urease positivity	
• Proteus • Ureaplasma • Nocardia • Cryptococcus • Helicobacter • Klebsiella • Staph saprophyticus • Staph epidermidis	

- Based on IMViC testing
  - Indole positivity → Red color
  - Methyl red positivity → Red color
  - VP test positive → Red color
  - Citrate utilization test positive → Blue color

IMViC test	Organisms
+ + - -	E.coli 
- - + +	Klebsiella 
- + - -	Yersinia
- + - -	Shigella
- + - +	Salmonella

LACTOSE FERMENTORS

0.07.39

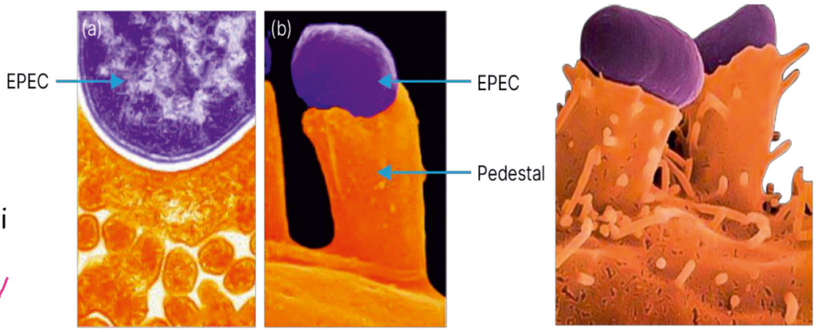
E.COLI

- Disease caused UTI and Diarrhoea

UTI

- MC cause is E.coli
- Diagnosis of UTI is by KASS criteria →> 10^5 CFU /ml in a urine sample
  - Exception for KASS criteria
    - → Suprapubic aspiration
    - → Gram-positive organism → S.aureus, Candida
    - → Antibiotics / Diuretics

DIARRHOEA

Strains	Description
EPEC (E.Pathogenic-EC)	• Cause → Infantile / Paediatric diarrhea • Pathology Plasmid ↓ Codes for ↓ Bundle-forming pili ↓ Cause attachment/ effacement lesion 

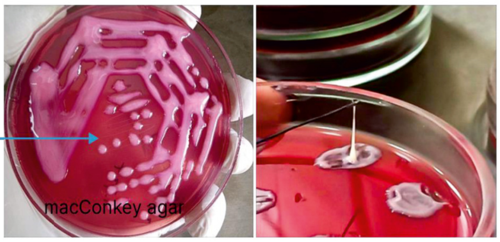
ETEC (E.Toxigenic EC)	• Cause → Traveller's diarrhoea • Pathology → Colonisation of factor Ag

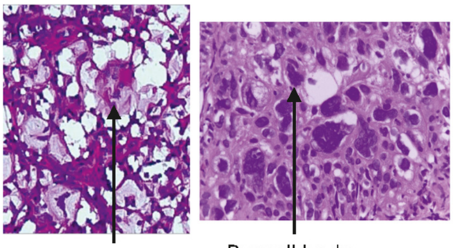
EIEC (E.Invasive EC)	• Cause → Dysentry
	• Pathology → Virulence marker Ag
	• Sereny test
	  ○ Inoculation suspension of bacteria into guinea pig's eye
	  ○ Severe mucopurulent conjunctivitis and severe keratitis indicate a positive test
	

EHEC (E.Hemorrhagic EC)	• Cause Hemolytic uremic syndrome
	  ○ MAHA - Microangiopathic hemolytic anemia
	  ○ Uremia
	  ○ Thrombocytopenia
	• Pathology → strain O157 : H7
	• E.coli are both lactose and sorbitol fermentors except EHEC, which is lactose fermentor and sorbitol non-fermentor

EAEC (E.Aggressive EC)	• Cause persistent diarrhoea (Diarrhoea > 14 days) • Pathology → Stacked brick appearance on Hep 2 cell line
DAEC (Diffuse Adherent EC)	

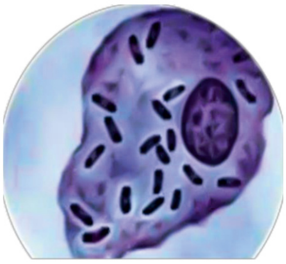
KLEBSIELLA

Organisms	Disease caused	Other features
K.pneumoniae (a/k/a Friedlander's bacilli)	• Pneumonia →Cough with sputum • H/O chronic alcoholic • Red current jelly sputum	• Capsulated organism - Form mucoid colony; as a result, it can be pulled • String sign + 
K.ozaenae	• Atrophic rhinitis	• Merciful anosmia → Foul-smelling discharge

K.rhinoscleromatis (a/k/a Freish bacillus)	• Rhinoscleroma	• Woody nose
		• Microscopy
		  ○ Mickulikz cells
		  ○ Russell bodies
		

Yourwish

Yourwish

K.granulomatis	• Donovanosis	• Painless genital ulcer- Beef red color
		• Donovan bodies
		• Safety pin appearance / Bipolar staining
		  ○ Wright Giemsa stain, Wayson stain
		
		• Other organisms showing a safety pin appearance
		  ○ Vibrio parahaemolyticus
		  ○ Yersinia pestis
		  ○ H. ducreyi, Burkholderia, kleb. granulomatis

NON LACTOSE FERMENTORS

00.18.22

SERRATIA MARSESCENS

- It is used as a control for filtration
- Produces a non-diffusible red pigment at room temperature → Prodigiosin
- Cause pneumonia
  - Cough with red sputum → Pseudohemoptysis

PROTEUS

- Motility → Swarming type
- Diene's phenomenon
  - Same strains → Swarming fuse
  - Different strains → Line of demarcation is formed
- Urease positive
- Odour → Fishy odour
- PPA +

SHIGELLA

INICET 2024

- Organisms includes
  - S.dysenteriae → cause dysentery
  - S.flexneri → MC in India
  - S.boydii
  - S.sonnei → MC in the world
- Non-lactose fermentors
  - S.dysenteriae
  - S.flexneri
  - S.boydii
- Late Lactose fermentors
  - S.sonnei

- Organisms that are catalase-positive and mannitol fermenters
  - S.flexneri
  - S.boydii
  - S.sonnei
- Organisms that are catalase-negative and mannitol non-fermenters
  - S.dysenteriae

DYSENTRY

- Caused by S.dysenteriae
- MOA : decrease 60s ribosomes → decreasing protein synthesis

DIAGNOSIS

- Transport media
  - SBGS (Sach's Buffered Glycerol Saline)
- Enrichment Media
  - Selenite F Broth
  - Tetrathionate Broth
- Selective Media
  - XLS (Xylose lysine deoxycholate)
  - DCA (Deoxycholate agar)
  - SS (Salmonella-Shigella agar)
  - HE (Hektoen enteric agar)

SALMONELLA

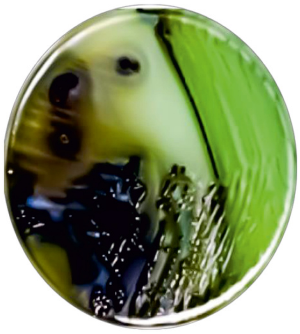
- Causes Enteric fever / Typhoid

CLINICAL FEATURES

- Stepladder type of fever pattern
- Ulcers produced in the GI are longitudinal type
- Diarrhoea
- Faget's sign → Fever with bradycardia
- Enlargement of the liver and spleen
- Rose spots
  - Appears in the 2nd week
  - Fade with pressure

DIAGNOSIS

- Week 1 → Blood culture
- Week 2 → Ab / widal test
- Week 3 → Stool culture
- Week 4 → Urine culture
- Enrichment Media
  - Selenite F Broth
  - Tetrathionate Broth
- Selective Media



- XLS (Xylose lysine deoxycholate)
- DCA(Deoxycholate agar)
- SS (Salmonella-Shigella agar)
- HE (Hektoen enteric agar)

- Differentiating media for Salmonella and Shigella → Wilson Blair media
  - S.typhi grows in Wilson Blair media and produces black colonies
- Newer test
  - Typhidot → IgM/IgG against outer membrane proteins
  - Dot blot → IgG against flagellar membrane protein antigen

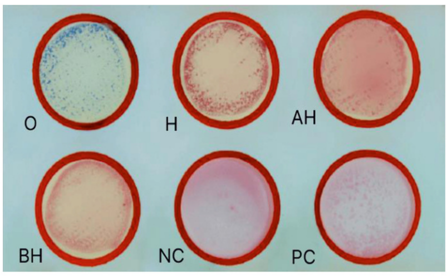
WIDAL TEST

- Salmonella has 3 antigens
  - O Ag
  - H antigen
  - Vi antigen
- O Ag
  - a/k/a somatic antigen
  - Present in the cell wall
  - Same for all strains
- H Ag
  - a/k/a Flagella antigen
  - Most immunogenic and highest antibodies
  - Each strain has a different antigen
    - → TH → S.typhi
    - → AH → S.paratyphi A
    - → BH → S.paratyphi B
- Vi Ag
  - Vi covers the O antigen
  - Used in vaccination

NEET PG 2023, 2024

Interpretation of Widal test → Slide Widal test

O Ag first appears, H Ag second appears, O Ag first disappears, H Ag second disappears

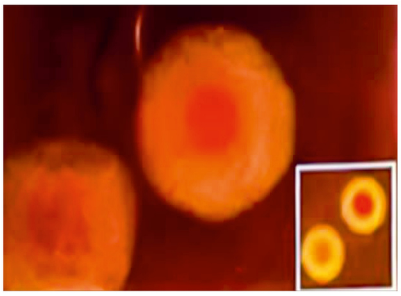


S.typhi	+	+	-	-
S.Paratyphi A	+	-	+	-
S.paratyphi B	+	-	-	+
Early typhoid	+	-	-	-

Late typhoid	-	+	-	-
Vaccine	-	+	+	+

Important Information
- MC cause of osteomyelitis → Staphylococcus aureus
- MC cause of osteomyelitis in sickle cell anemia → Salmonella enteritidis

YERSINIA
YERSINIOSIS
- Caused by Yersinia enterocolitica and Yersinia pseudo-tuberculosis
  - Belongs to the Enterobacteriaceae family
- Causes Ileitis and mesenteric lymphadenitis
- Pseudoappendicitis
  - Cause pain in the right lower quadrant → mimics appendicitis
- Cold enrichment
- Differential motility - Similar to Listeria
  - Motile at 22°C and non-motile at 37°C
- Diagnosis
  - Urease positive
  - CIN agar → Target colonies / Bull's eye colonies



PLAGUE
- Caused by Yersinia pestis → Miscellaneous bacteria
- Reservoir → Rat
- Vector → Rat flea

TYPES
- Bubonic plague
  - IP: 2 - 7 days
  - Fever with painful enlargement of lymph nodes
- Pneumonic plague
  - IP: 1 - 3 days
  - Respiratory symptoms
  - Bioterrorism agent
- Septicemic plague
  - a/k/a Black death
  - IP: 2 - 7 days

INVESTIGATIONS
- Samples collected depending on the type of plague
- Sample includes Blood, sputum, and Bubo
- Microscopy
  - Safety pin appearance / Bipolar staining on Wright Giemsa stain, Wayson stain

Yourwish

- Culture
  - Ghee broth → Stalactite growth


VIBRIO

- Classified based on growth in salt
  - Halophilic → needs 7 - 10% salt for growth
    - → V.parahaemolyticus
    - → V.alginolyticus
    - → V.vulnificus
  - Non - Halophilic → cannot grow at high salt
    - → V.cholerae
    - → V.mimicus

NON-HALOPHILIC ORGANISM (VIBRIO CHOLERAE)

- 2 strain → classical and EL TOR (act as carrier)

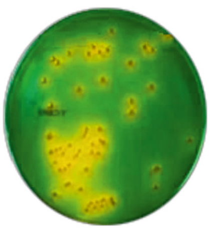
	Classical	EL TOR
Polymyxin B sensitivity	Sensitive	Resistant
Phage IV susceptibility	Susceptible	Resistant
-hemolysis on sheep blood agar	Negative	Positive
Chick Erythrocyte Agglutination	Negative	Positive
VP test	Negative	Positive

MECHANISM OF ACTION

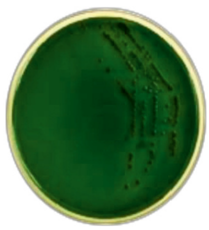
- Act with the help of Cholera toxin and Zonula occludens toxin
- Cholera toxin
  - Fragment A: Increase cAMP → increase adenylate cyclase → Rice water stool
  - Fragment B: Bind to GM1 ganglioside
- Zonula occludens toxin
  - Helps in cell-to-cell infection

DIAGNOSIS

- Rice water stools
- Transport media
  - VR media, Cary Blair media

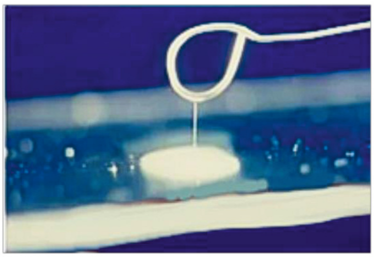


Vibrio cholerae on TCBS agar Sucrose Fermenter



Vibrio pharahaemolyticus on TCBS Agar Non Sucrose Fermenter Sucrose Fermenter

- Culture media → TCBS - Thiosulphate citrate bile salt sucrose agar
  - Sucrose fermentors appear yellow
  - Indicator →Bromothymol blue
- Gelatin swab
  - Napiform / Turnip appearance → Vibrio cholerae
  - Inverted fir tree appearance → Bacillus anthrax
  - Fir tree appearance → Clostridium tetani
- Biochemical test
  - Comma-shaped - Darting or shooting type of mobility → Fish in stream
  - Cholera red reaction due to the presence of compound Nitroso Indole
  - Catalase +
  - Oxidase +
  - Indole test +
  - Nitrate reduction +
  - Sucrose fermentor → appears yellow on TCBS
  - String test



Positive String Test

Important Information

- Darting or shooting type of mobility
  - V.cholerae, Campylobacter
- String test seen in
  - Giardia, Klebsiella, Vibrio
- Toxins increasing cAMP
  - Cholera, Anthrax, ETEC (labile), Pertussis, B.cereus - Diarrheal
- Toxins increasing cGMP
  - ETEC (stable), B.cereus - Emetic
- Oxidase positive
  - Pseudomonas, Vibrio cholera, Neisseria, Campylobacter, Helicobacter

HALOPHILIC ORGANISM

V.parahaemolyticus	V.Vulnificus	V.alginolyticus
• Seafood poisoning after consumption of prawns	• Sepsis	• Otitis media and conjunctivitis
Wound infection		
• Wagatsuma agar ○ Blood agar with 2-4% salt ○ Kanagawa phenomenon→ pathogenic strains are hemolytic		• Most tolerant to NaCl (> 10%)
• Swarming motility seen		• Swarming motility seen

NON - FERMENTORS

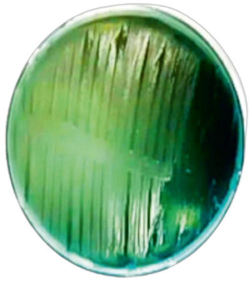
00:52:06

- Does not ferment any sugar, like Lactose and Maltose

- Pseudomonas
- Burkholderia mallei
- Burkholderia pseudomallei
- Acinetobacter baumannii

PSEUDOMONAS

- MOA: Decreases protein synthesis
- Pigments present
  - Pyocyanin → Blue green
    → Diffusible
    → Enhanced on King Media
  - Pyoverdin → Green yellow
  - Pyorubin → Red
  - Pyomelanin → Brown
- Disease caused
  - Pneumonia
  - Swimmer's ear
  - Hot tub folliculitis / Jacuzzi fever
  - Contact lens-associated corneal ulcers
  - Shanghai fever
  - Meningitis
  - UTI
  - Burn wound infections
  - Green nail syndrome
- Other features of Pseudomonas
  - Sweet/fruity odour
  - Iridescence colonies- Metallic sheen
  - Uses sugar oxidatively
  - Motile organism
  - Non - Lactose fermentors
  - Selective media → Cetrimide agar



Blue Green Pigment

Important Information

WHO priority organisms causing Nosocomial infections having MDR

- Enterococcus faecium
- S. aureus
- Klebsiella pneumoniae
- Acinetobacter baumannii
- Pseudomonas Aeruginosa
- Enterobacter species

BURKHOLDERIA

BURKHOLDERIA CEPACIA

- MC species

- Most potent → Resistant to antibodies
- A/w cystic fibrosis

BURKHOLDERIA MALLEI

- Seen in animals, cause Glanders disease
- Diagnosis → Strauss reaction
  - Inoculation in guinea pig causes scrotal swelling

BURKHOLDERIA PSEUDOMALLEI

- A/k/a Whitmore bacillus
- Causes → Melioidosis
  - Occurred in Vietnam after the attack of bomb blast
  - Clinical features → skin ulcer and pneumonia
- Culture → Ashdown agar
- Microscopy → Safety pin appearance
- Treatment
  - Carbepenem
  - Imipenem

HBB

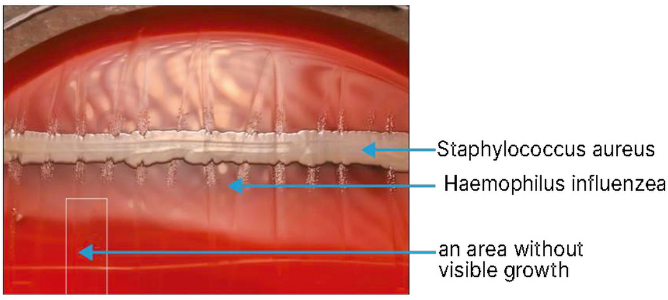
00.59.00

- Includes Hemophilus, Bordetella, and Brucella

HEMOPHILUS

HEMOPHILUS INFLUENZA

- a/k/a Pfeiffer bacillus
- Needs both factor V and X
- Virulence factor present is Capsular polysaccharide
  - Based on capsular polysaccharide, H. influenzae is divided into 6 types: A - F
  - The vaccine is made with type H.influenzae type B
- Clinical features
  - Croup / Laryngeotracheobronchitis
  - Meningitis
  - Pneumonia
- Diagnosis → H.influenzae exhibits Satellitism



Streak of S.aureus colonies made on blood agar

↓

S. aureus causes hemolysis and releases factor V and X

↓

On inoculation with H.influenzae

↓

It grows along the line of S.aureus

- Treatment
  - Cefotaxime
  - Ceftriaxone

Yourwish

HEMOPHILUS DUCREYI

- Causes → Chancroid
  - Painful genital ulcer
  - Soft chancre
- Culture media
  - Grows on chocolate agar supplemented with Isovitalex and fetal calf serum
- Microscopy
  - School of fish and safety pin appearance
- Treatment
  - Azithromycin

VARIOUS STRAINS OF HEMOPHILUS

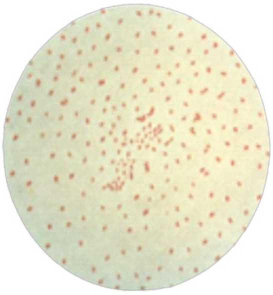
Factors	X	V	CO_2	Hemolysis
H. Influenzae	+	+	-	-
H. Aegyptius	+	+	-	-
H. Ducreyi	+	-	-	-
H. Parainfluenzae	-	+	-	-
H. Haemolyticus	+	+	-	+
H. Parahaemolyticus	-	+	-	+
H. Aphrophilus	-	-	+	-
H. Paraphrophilus	-	+	+	-

BORDETELLA PERTUSIS

- Toxin present → cAMP
- Disease caused → Whooping cough/pertussis

PERTUSIS

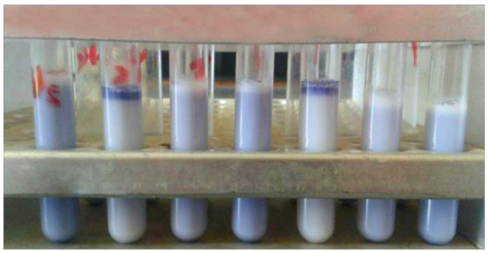
- 3 phases of pertussis
  - Catarrhal phase
    - → Fever with dry cough
    - → Maximum infectivity
  - Paroxysmal phase → Presence of whooping cough
  - Convalescent phase
- Culture media → Bordet - Gengou medium
  - Sample obtained by nasopharyngeal and oropharyngeal swab / asking the person to cough on the culture plate
  - Appearance: Bisected pearls/mercury drops → Aluminum paint appearance
- Microscopy → Thumb print appearance
- Vaccination



- Acellular vaccine is used, which has FHA, PT, AGG, and PERT
- No complication is observed
- Treatment → Erythromycin, Azithromycin

BRUCELLA

- Cause zoonotic disease
- Clinical features
  - Night sweets
  - Arthritis
  - Hepatosplenomegaly
- Biochemical test → Catalase, oxidase, and urease positive
- Diagnosis → Test done in Humans
  - Sample grown in Castaneda biphasic media
    → It has both liquid and solid components
  - Standard agglutination test
    → Detects both Ab → IgM and IgG
    → To differentiate between past and current infection, 2-mercaptoethanol is added, where IgM is destroyed



- Diagnosis → Test done in animals
  - Milk ring test +
- Treatment
  - Doxycycline for 45 days + Inj.Streptomycin IM daily for 14 days

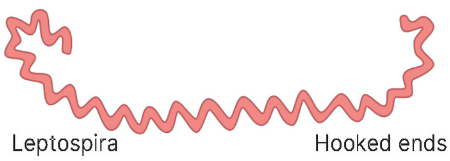
GRAM-POOR ORGANISM

01:10:12

- It includes the following organisms
  - Mycloplasma
  - Rickettsia
  - Chlamydia
  - Spirochetes

SPIROCHETES

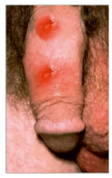
- Shape → Spiral
- Motility → presence of Endoflagella in periplasmic space

Types of spirochetes		
Treponema pallidum	• Tight coils • Corkscrew motility	
Borrelia	• Loose coils • Lashing motility	
Leptospira	• Hooked ends • Motile organism	

TREPONEMA PALLIDUM

- Disease caused Syphilis - STD
- Incubation period: 9-90 days

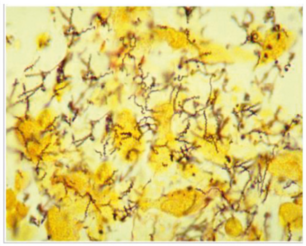
SYPHILIS



- Primary syphilis
  - Painless genital ulcer → Hard chancre
  - Painless lymph nodes

- Secondary syphilis
  - Rash present on both hands and feet
  - Condylomata lata → lesion seen in mucocutaneous junction

- Tertiary syphilis
  - Gumma → Granulomatous
  - Cardiosyphilis → Tree bark appearance of aorta
  - Neurosyphilis / General paresis



- Microscopic diagnosis
  - Dark field microscopy
  - Silver impregnation with light microscopy
    → Tissue sample → Levaditi stain
    → Fluid sample → Fontana stain
- Serological diagnosis: Specific and Non-specific tests
  - Most sensitive: FTA - ABS
  - Most specific: TPI > TPPA

Non - specific test	Specific test
• Wasserman test → Complement fixation test • Khan test • VDRL (Microscopic test) ○ Venereal Disease Research Laboratory ○ Blood, CSF ○ Cardiolipin Ag → Lipid from heart obtained from beef + Lecithin. → Used within 24 hrs ○ Preheating the sample containing Ab ○ IOC - neurosyphilis • RPR (card test) ○ Rapid Plasma Reagin ○ No Ag preparation is required ○ No pre-heating required	• FTA - ABS → Fluorescent Treponemal antibody absorption • TPI → Treponema pallidum immobilization • TPHA → Treponema pallidum hemagglutination • TPPA → Treponema pallidum particulate agglutination

- Treatment → Benzathine penicillin

BORRELLIA

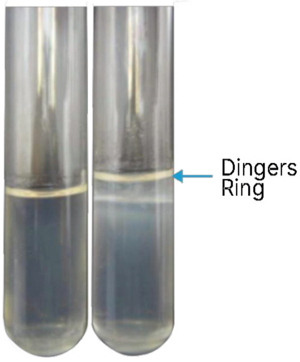
INICET 2024

Organisms	Disease	Features
Borrelia burgdorferi	Lyme disease (USA)	• Transmitted by the bite of Ixodid tick • Localized infection ○ Erythema chronicum migrans / Bull's eye / Target sign / annular rash 
Borrelia vincenti	Vincet's angina	• Ulcerative gingivostomatitis or oropharyngitis
Borrelia recurrentis	Epidemic relapsing fever	• Transmitted by Louse • Blood sample taken during fever • Treatment → Tetracyclines, chloramphenicol
Borrelia duttoni	Endemic relapsing fever	• Transmitted by Tick • Blood sample taken during fever • Treatment → Tetracyclines, chloramphenicol

LEPTOSPIRA

- Cause Weil's disease

WEIL'S DISEASE



- a/k/a Icterohemorrhagic fever / Hepatorenal syndrome
- Clinical features
  - Conjunctival suffusion
  - Jaundice
- 4 R
  - Rat urine
  - Rainy water
  - Rice field/paddy field worker
  - Dinger's Ring on EMJH media
- Diagnosis
  - Serology → Microscopic agglutination test - detection of antibodies

CHLAMYDIA

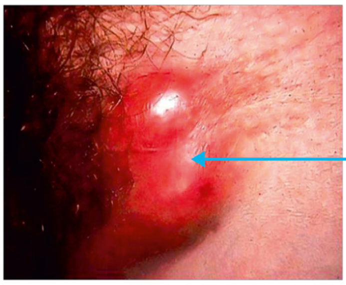
FMGE 2021, 2025

- Atypical bacteria- Has no peptidoglycan cell wall
- Extract ATP from the host
- Has Basophilic bacterial inclusions
- Organisms cannot be cultured → Intracellular organisms
- Chlamydia exists in 2 forms

- Elementary body
  - → Entry and exit form
  - → Amount of RNA = DNA
- Reticulate body
  - → Replication form
  - → Amount of RNA > DNA

Types of Chlamydia		
C.trachomatis A,B,Ba,C	Trachoma	• HP bodies → Halbersteider Prowazeki bodies • SAFE strategy

C.trachomatis D,E,F,G,H,I,K	Occurs in neonates and pregnant women	• Neonates
		  ○ Inclusion conjunctivitis
		  ○ Ophthalmia neonatorum
		• Pregnant female
		  ○ Non-gonococcal conjunctivitis

C.trachomatis L1, L2, L3	Lymphogranuloma venereum	• Asymptomatic • Buboes → painful inguinal lymph nodes • Conjunctivitis, urethritis, polyarthritis • DOC - Doxycycline • Esthiomene ○ Rectal and urethral stricture • Fries test • Fitz Hugh Curtis syndrome (Perihepatitis with violin string appearance) • Groove sign → enlarged lymph node separated by inguinal ligament  Groove sign
C.pneumoniae	Pneumonia	• TWAR strain
C.psittaci		• Transmitted from pigeons • Liventhal Cole Lillie bodies

RICKETTSIA

- Intracellular organism
- In all rickettsial diseases, rash starts from trunk and spreads to the extremities except RMSF, where rash starts from the extremities and spreads to the trunk
- Brill-Zinsser disease

- a/k/a Zinsser disease / recrudescent typhus/reactivation typhus
- a/w epidemic typhus
- Less severe and is not associated with any vector

	Caused organism	Arthropods Involved
Epidemic Typhus	R. prowazekii	Louse
Endemic Typhus	R. typhi	Flea
RMSF	R. rickettsii	Tick
Indian Tick Typhus	R. conorii	Tick
African Tick Typhus	R. africase	Tick
Rickettsial pox	R. akari	Mite
Scrub Typhus	Orientia tsutsugamushi	Mite

- Neil Mooser reaction
  - a/k/a Tunica reaction
  - Procedure

Intraperitoneal inoculation of Guinea pig with blood from the case
↓
Scrotal inflammation
↓
Positive reaction

  - Interpretation
    → Positive → Endemic typhus
    → Negative → Epidemic typhus

SCRUB TYPHUS

- Cause chiggerosis

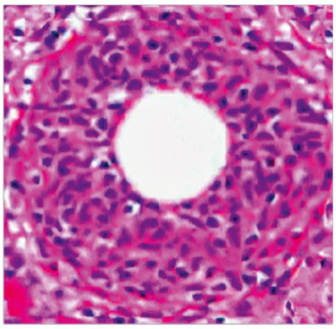
CHIGGEROSIS

- Zoonotic tetrad
  - Present in vegetation/shrubs
  - Transmitted from → Rat/squirrel
  - Transmitted by → Larvae of mites called chiggers
  - Infects humans
- Diagnosis
  - Do not stain with Gram's reagent
  - Special stains used are Giemsa, Castaneda, Gimenez, Macchiavello
  - Culture → Yolk sac of embryonated Hen's egg cell lines
- Serological test → Weil-Felix reaction

- Rickettsia Ab reacts with Proteus Ag
- Heterophile agglutination test

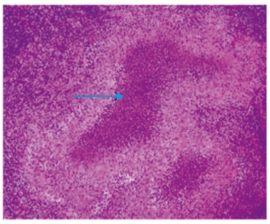
Interpretation of the Weil-Felix reaction			
	OX19	OX2	OX K
Epidemic typhus	+++	+	-
Brill Zinsser	-	-	-
Endemic typhus	+++	+/-	-
RMSF	++	++	-
Scrub typhus	-	-	+++

COXELLIA BURNETTI



- Intracellular organisms
- Acquired by the inhalational route
- Causes Q fever
  - Doughnut / Fibrin ring granuloma
  - Treatment → Tetracycline (DOC)
- Has no vector, does not produce rash, and does not show Weil-Felix reaction

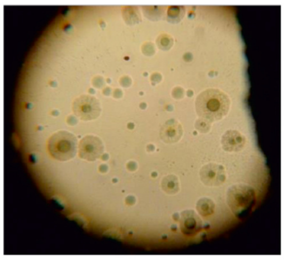
BARTONELLA

Organisms	Disease	Arthropod
Bartonella bacilliformis	Oroya fever/carrion fever	Sandfly
Bartonella quintana	Trench fever / 5-day fever	Louse
Bartonella henselae	Cat scratch disease → cause stellate granuloma (Also seen in LGV) 	
	Bacillary angiomatosis → Dilatation of blood vessels in skin	
	Peliosis → Dilatation of sinusoids in liver	

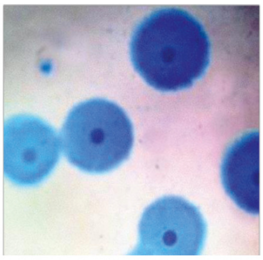
MYCOPLASMA

- a/k/a Eaton agent or PPLO (Pleuro pneumonia like organism)
- Smallest bacteria
- No cell wall, but has sterols in the cell membrane
- MC cause of Walking pneumonia / Atypical pneumonia
- PPLO agar → fried egg colonies
  - Diene's stain is used for visualization
- Diagnosis → Cold agglutination test

PPLO Agar



Diene's Stain



Yourwish

Important Information

- Cold agglutination test → Mycoplasma
- Standard agglutination test → Brucella
- Microscopic agglutination test → Leptospira

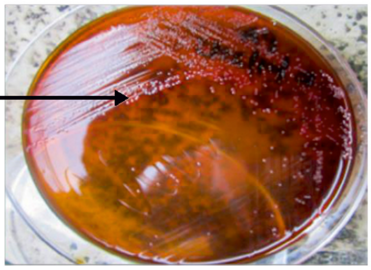
MISCELLANEOUS

01.41.17

- Campylobacter
- Helicobacter

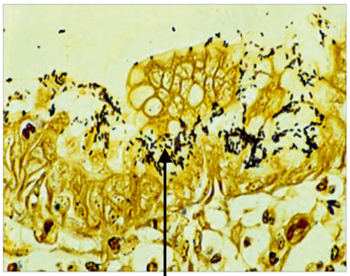
CAMPYLOBACTER JEJUNI

- Spiral in shape
- Acquired from undercooked poultry
- IP: 1 - 7 days
- Clinical features
  - Diarrhoea → GBS
- Biochemical test → Catalase and oxidase positive
- Microscopy
  - Spiral / gull wing → Shooting star / Darting motility
- Culture
  - Campy bap, Skirrow, Butzler → Effuse droplet colony
  - Grows at 42°C

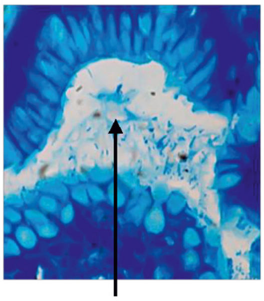


HELICOBACTER PYLORI

- Clinical features
  - Gastritis
  - Peptic ulcer disease
  - Carcinoma → develops due to virulence factors like CagA and VacA
    → Gastric adenocarcinoma
    → Gastric maltoma
- Stain
  - Warthin starry silver stain
  - Modified Giemsa stain (Best)



Warthin starry silver stain



Modifeid giemsa stain

SUMMARY

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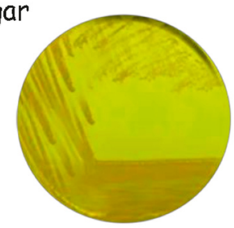
CULTURE MEDIA

Organism	Culture media
Staphylococcus aureus	• Mannitol salt agar / Ludlam salt agar ○ Indicator → Phenol red • Mannitol fermentors appear yellow  Staphylococcus aureus  Staphylococcus epidermidis

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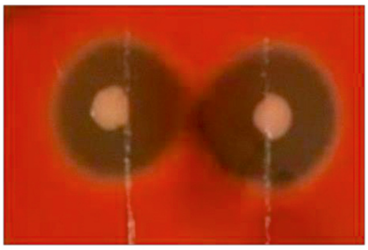
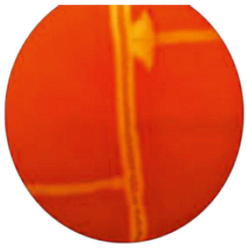
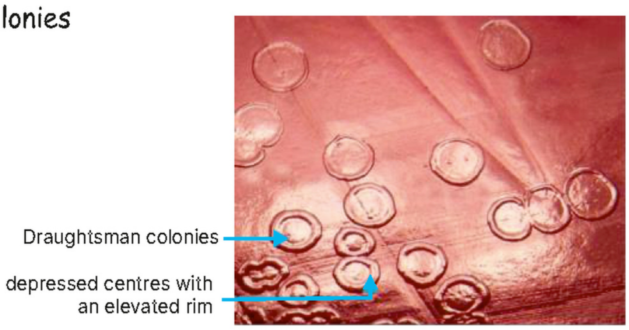
Streptococcus pyogenes	• Pinpoint colonies
	• Wide zone hemolysis
	• Transport media → Pike media's
	• Selective media
	  ○ PNF
	  ○ Crystal violet blood agar
	  ○ On liquid media →granular colonies
	

Streptococcus agalactiae	• CAMP test positive • CAMP test is also shown by Listeria  CAMP Test
Streptococcus pneumoniae	• Draughtsman/carrom colonies 
Enterococcus	• Spectacle shaped • Bile esculin azide agar → Black colonies 

Neisseria	• Transport media → Amies / Stuart media
	• Culture media → Modified Thayer Martin media
	  ○ Trimethoprium
	  ○ Vancomycin
	  ○ Nystatin
	  ○ Colistin

Corynebacterium diphtheria	• a/k/a Kleb loeffler bacillus
	• Enriched media
	  ○ Loeffler serum slope → earliest for diagnosis
	  ○ Grows within 6-8 hrs
	• Selective media
	  ○ Potassium tellurite agar → best
	  ○ Grows after 48 hrs

Bacillus anthrax	• Medusa head appearance • Penicillin agar → String of pearls

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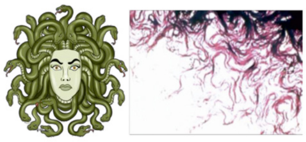
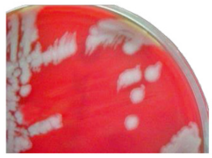
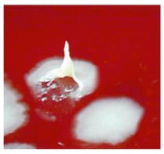
- Frosted glass
- Comet tail
- Beaten egg
- Gelatin agar → Inverted fir tree appearance


Medusa head

Frosted glass

Comet tail

Beaten egg

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<tr>
<td>Bacillus cereus</td>
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- MYPA
- PEMBA

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<tr>
<td>Clostridium tetani</td>
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- Robertson cooked meat broth - Anaerobic
- Swarming motility
- Gelatin agar → Fir tree appearance

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<tr>
<td>Clostridium perfringens</td>
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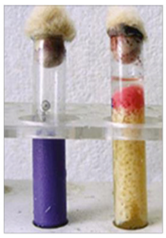
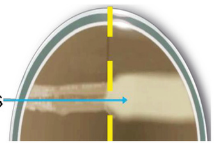
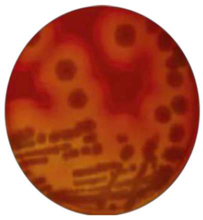
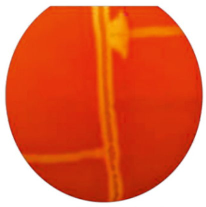

Cl. perfringens



CAMP Test

- Robertson cooked meat broth- Anaerobic
- Stormy clot
- Naegler reaction
- Target hemolysis
- Reverse CAMP

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<tr>
<td>Clostridium difficile</td>
<td>

- CCFA
- CCYA

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<tr>
<td>Lactose fermentors</td>
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- E.coli, Klebsiella, Citrobacter, Enterobacter

MacConkey agar

- Differential, Indicator, and Selective media
- Composition
  - Peptone

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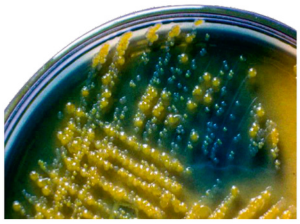
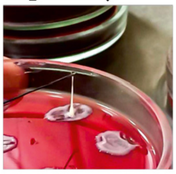
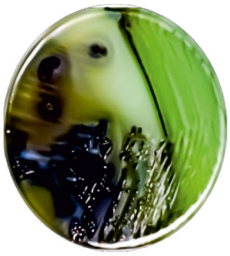
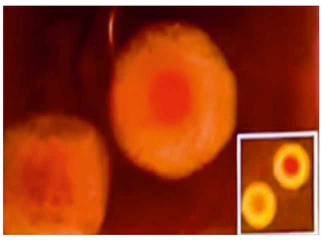
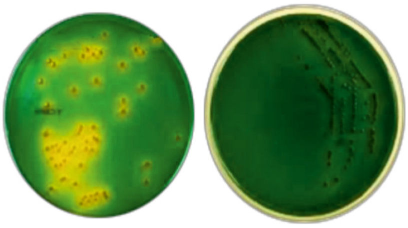
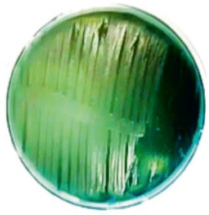
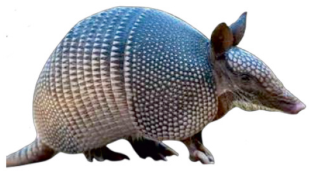
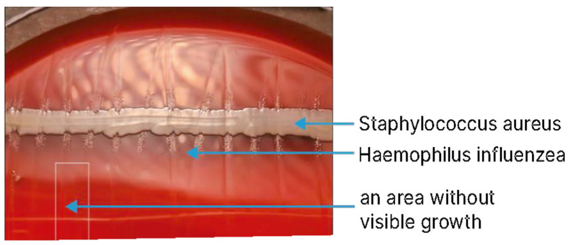
</table>

	○ Lactose ○ Agar ○ Neutral red → Indicator dye ○ Taurocholate → Bile salts • Lactose fermentors → Pink color **CLED** • Cysteine lactose electrolyte-deficient • Indicator → Bromothymol Blue (BTB) • Lactose fermentors → Yellow  CLED
Klebsiella	• String test positive 
Non-lactose fermentors	• Salmonella , Shigella , Yersinia , Proteus
Late lactose fermentors	• Shigella sonnei
Salmonella and Shigella	• Enrichment Media ○ Selenite F Broth ○ Tetrathionate Broth • Selective Media ○ XLS (Xylose lysine deoxycholate) ○ DCA(Deoxycholate agar) ○ SS (Salmonella-Shigella agar) ○ HE (Hektoen enteric agar) • Differentiating media for Salmonella and Shigella → Wilson Blair media ○ S.typhi grows in Wilson Blair media and produces **black colonies** 
Yersinia enterocolitica	• CIN agar → Target colonies / Bull's eye colonies 
Yersenia pestis	• Ghee broth → Stalactile growth 

Yourwish

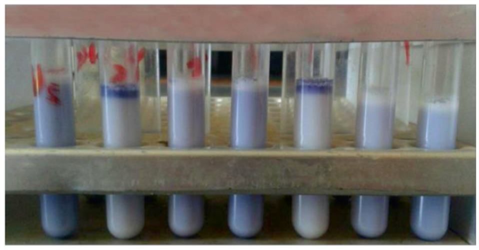
Oral actinomyces	• Molar tooth colonies  

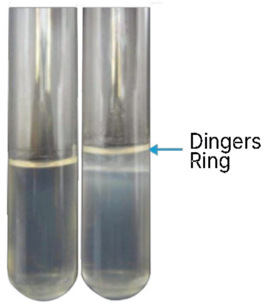
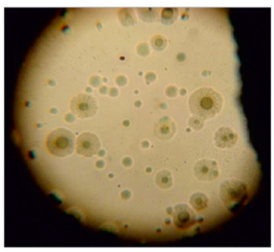
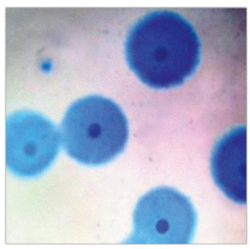
Vibrio cholerae	• Transport media
	  ○ VR media, Cary Blair media
	• Culture media → TCBS - Thiosulphate citrate bile salt sucrose agar
	  ○ Sucrose fermentors appear yellow
	  ○ Indicator →Bromothymol blue
	

Pseudomonas	• Colonies appear blue-green → Pyocyanin • Selective media → Cetrimide agar 
Burkholderia	• Occurred in Vietnam after the attack of bomb blast • Culture → Ashdown agar
Mycobacterium tuberculosis	• LJ media → Rough, buff, and tough colonies • Time to grow is 6-8 weeks 
Mycobacterium leprae	• Nine-banded armadillo/foot pad mice 
Haemophilus influenzae	• a/k/a Pfeiffer bacillus • Needs both factor V and X ○ Diagnosis → H.influenzae exhibits Satellitism 

Haemophilus ducreyi	• Needs only factor X
	• Causes → Chancroid
	  ○ Painful genital ulcer
	  ○ Soft chancre

	• Culture media ○ Grows on chocolate agar supplemented with Isovitalex and fetal calf serum 
Bordetella pertusis	• Culture media → Bordet - Gengou medium • Appearance: Bisected pearls/mercury drops → Aluminum paint appearance 

Brucella	• Diagnosis → Test done in Humans
	  ○ Sample grown in Castaneda biphasic media
	  ○ It has both liquid and solid media
	  ○ Standard agglutination test
	• Diagnosis → Test done in animals
	  ○ Milk ring test +
	

Leptospira	• Rat urine • Rainy water • Rice field/paddy field worker • Dinger's Ring on EMJH media 
Legionella	• BCYE agar • MC with humidifiers → Pneumonia
Mycoplasma	• PPLO agar → fried egg colonies ○ Diene's stain is used for visualization   PPLO agar  Diene's agar
Campylobacter	• Campy bap, Skirrow, Butzler → Effuse droplet colony

FERMENTATIONS

	Media	Color	Indicator
Mannitol fermentors (S.aureus)	Mannitol salt agar	Yellow	Phenol red

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Sucrose fermentors (V.cholera)	TCBS	Yellow	Bromothymol Blue
Lactose fermentors (E.coli, Klebsiella)	CLED	Yellow	Bromothymol Blue
	MacConkey	Pink	Neutral red

PYQ

01.55.29

Q.Which culture medium is used to distinguish lactose fermenters from non-lactose fermenters?

FMGE Jan 2023

a. Bile salt agar

b.Thayer-Martin agar

c. Sabouraud Dextrose Agar

d. MacConkey agar

Answer: **d**

- Bile salt agar → Enterococcus
- Thayer Martin Media → Neisseria
- Sabouraud dextrose agar → Fungus

Q.Which type of microscope can be used to detect the motility of the probable causative organism in a truck driver presenting with painless indurated genital ulcer following unprotected sexual activity?

NEET PG 2021

a. Dark-field microscope

b. Electron microscope

c. Light microscope

d. Fluorescent microscope

Answer: **a**

Q. Escherichia coli can be grown best in which of the following media?

FMGE Dec 2021

a. Chocolate agar

b. Thayer-Martin agar

c. Sabouraud dextrose agar

d. MacConkey agar

Answer: **d**

- CLED > MacConkey agar

Q. Which pathogen causes attachment & effacement lesions in the intestinal mucosa, as shown in the image?

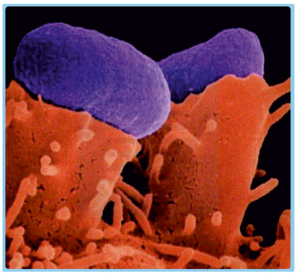
INICET Nov 2021

a. Enterotoxigenic Escherichia coli

b. Enteropathogenic Escherichia coli

c. Enteroinvasive Escherichia coli

d. Diffusely adherent Escherichia coli



Answer: **b**

Q. A 2-year-old child with a history of diarrhoea presented with fever, thrombocytopenia, and hematuria. Which of the following can be the likely cause?
a. Escherichia coli 0157:H7
b. Salmonella
c. Shigella
d. Yersinia

Answer: **a**

Q. A group of students consumed fried rice in a restaurant. Six hours later, they start vomiting. What is the etiological agent?
a. Bacillus cereus
b. Clostridium botulinum
c. Escherichia coli
d. Shigella dysentriae

Answer: **a**

Q. A 26-year-old male presents with fever, abdominal pain, and diarrhea for 3 days. He reports consuming raw fish prior to symptom onset. He is hemodynamically stable, and stool examination reveals no pus cells. Culture grows on Wagatsuma agar. What is the most likely causative agent?
a.Vibrio cholerae
b.Salmonella typhi
c.Shigella sonnei
d.Vibrio parahaemolyticus

Answer: **d**

Q. A sewage worker presented with abdominal pain, jaundice, conjunctival injection, and hematuria for the past 5 days. Which of the following is the investigation of choice?
a.Widal test
b.Microscopic agglutination test (MAT)
c.Weil-Felix reaction
d.Paul-Bunnell test

Answer: **b**

- Cold agglutination test → Mycoplasma
- Standard agglutination test → Brucella
- Microscopic agglutination test → Leptospira

Q. A man occasionally eats outside due to traveling reasons. He presents to a physician with abdominal pain for 4 days, along with a history of fever and bradycardia. Which test is used to confirm the diagnosis?
a. Blood culture
b. Widal test

c. Stool culture
d. Urine culture

Answer: **a**

- Week 1 → Blood culture
- Week 2 → Ab / widal test
- Week 3 → stool culture
- Week 4 → urine culture

Q. A 21-year-old girl who presented with multiple beefy-red painless ulcers over the vulval region is diagnosed with granuloma inguinale. What is the causative organism?
a. Chlamydia trachomatis
b. Klebsiella granulomatis
c. Haemophilus ducreyi
d. Herpes simplex virus 2

Answer: **b**

Q. A person with the H/o long-term sexual relationship presented with painful ulcers on his genitals with tender lymphadenopathy. What is the diagnosis?
a. Gonorrhoea
b. Chlamydia
c. LGV
d. Chancroid

Answer: **d**

Q. For the diagnosis of typhus, an antigen of Proteus is used. What is this type of antigen called?
a. Sequestered antigen
b. Super antigen
c. Iso antigen
d. Heterophile antigen

Answer: **d**

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4. VIROLOGY PART 1

GENERAL PROPERTIES AND STRUCTURE OF VIRUSES

00:00:28

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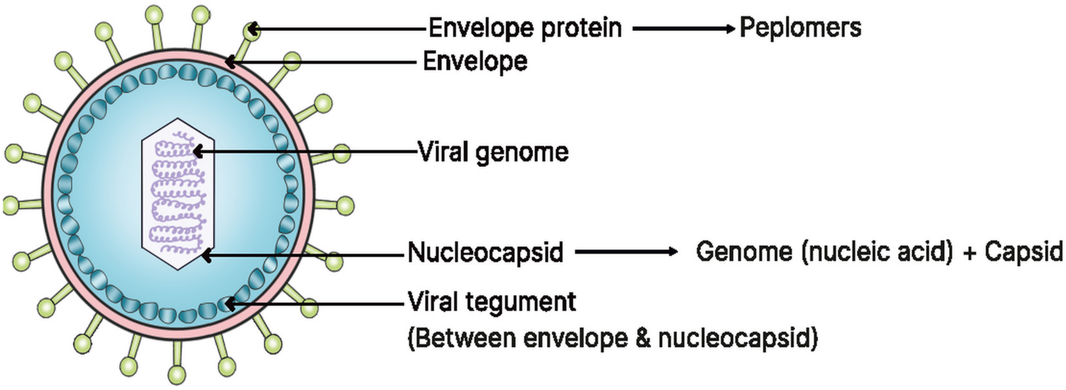

- Envelope: Outermost layer present in some viruses.
- Envelope Proteins: Projections from the envelope
  - Also known as peplomers.
- Nucleocapsid: Combined term for the internal genetic material and its protein covering.
  - Genetic Material: Viruses contain either DNA or RNA, never both.
  - Capsid: The protein shell covering the DNA or RNA.
  - Tegument: The space/material lying between the nucleocapsid and the envelope.

Envelope

- Composition: Lipoprotein.
- Sensitivity: Envelopes are easily dissolved by:
  - Ether sensitive
  - Alcohol
  - Bile salts
  - Heat labile/sensitive
- Clinical Application: Hand sanitizers containing alcohol effectively kill enveloped viruses.

Non Enveloped Viruses

DNA VIRUSES: "PAP"	RNA VIRUSES: "PARCH-E"
• Parvovirus. • Adenovirus • Papovavirus.	• Picornavirus. • Astrovirus. • Reovirus. • Calicivirus • Hepatitis A and E.

- Note: Most non-enveloped viruses are associated with causing gastroenteritis.

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Symmetry of Nucleocapsid

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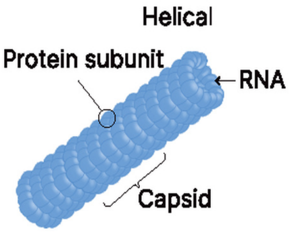
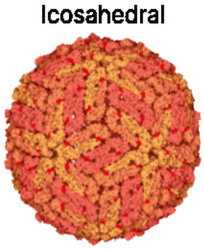
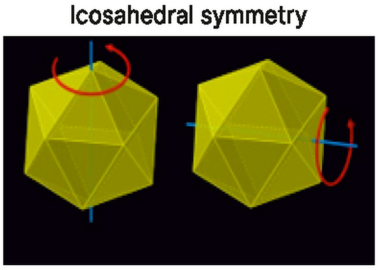
- Icosahedral: Seen in all DNA viruses except Poxvirus.
  - Poxvirus has complex symmetry.
- Helical: Seen in most RNA viruses (Mnemonic: "He is Mr. FAB")
  - Myxovirus, Rhabdovirus, Filovirus, Arenavirus, Bunyavirus.







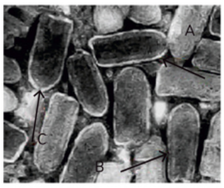
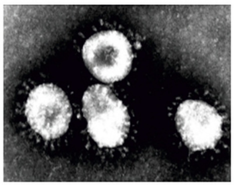
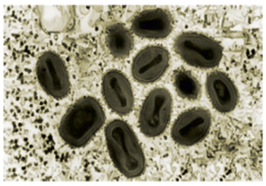
INICET 2023, 2024

DNA Viruses	RNA viruses
• Hepadnaviridae: HBV • Herpesviridae: HSV, HZV, EBV, CMV, HHV (1-8) • Adenoviridae: Adenovirus • Poxviridae: Variola, Vaccinia, Molluscum • Papovaviridae: HPV, BK, JC, Polyoma • Parvoviridae: Parvovirus • Bacteriophage → Transduction	• Picornaviridae • Paramyxoviridae • Caliciviridae • Togaviridae • Orthomyxoviridae • Bunyaviridae • Flaviviridae • Arenaviridae • Coronaviridae • Reoviridae • Rhabdoviridae • Retroviridae • Filoviridae

Size of Viruses

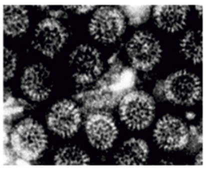
- Overall range: 20 nm to 300 nm.
- Largest virus: Poxvirus (300 nm).
- Smallest virus: Parvovirus (20 nm).
- Genome Size:
  - Largest genome: Retrovirus (HIV).
  - Smallest genome: Hepatitis D virus, followed by Hepatitis B virus.

Shape and Structure of Viruses (Electron Microscopy)

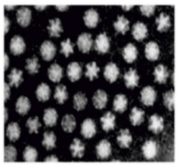
• Rabies Virus: Bullet-shaped 	• Coronavirus: Crown-like appearance due to petal-like peplomers. 	• Poxvirus: Box-shaped or Brick-shaped. ○ Dumbbell-shaped DNA. 

- Ebola Virus: Spaghetti-like, thread-like, or filamentous

- Rotavirus: Wheel-shaped



- Astrovirus: Star-shaped.



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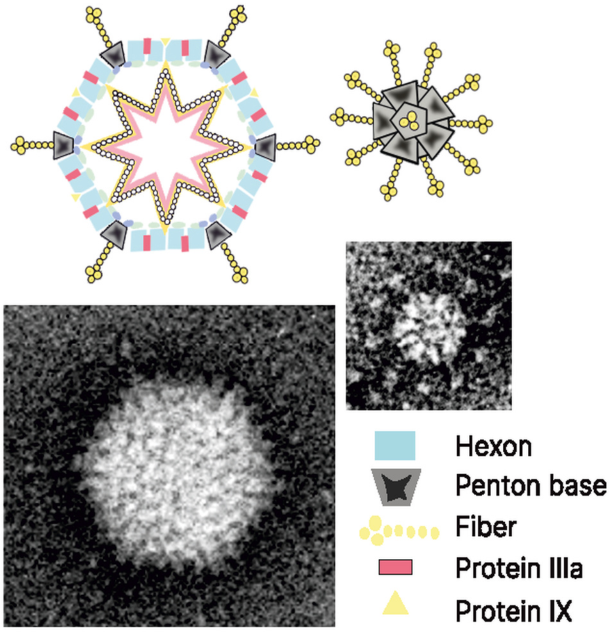
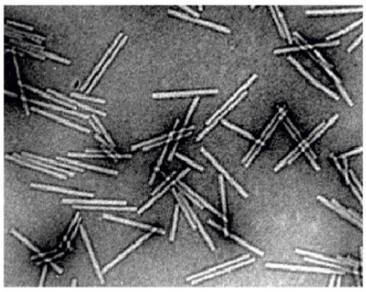
- Adenovirus: Spaceship or UFO appearance.



- Tobacco Mosaic Virus (TMV): Rod-shaped or cigarette/cigar-shaped.



Genomic configuration

00:11:54

Dna viruses

- General rule: All are double-stranded (dsDNA).
- Exception: Parvovirus is single-stranded (ssDNA).

Rna Viruses

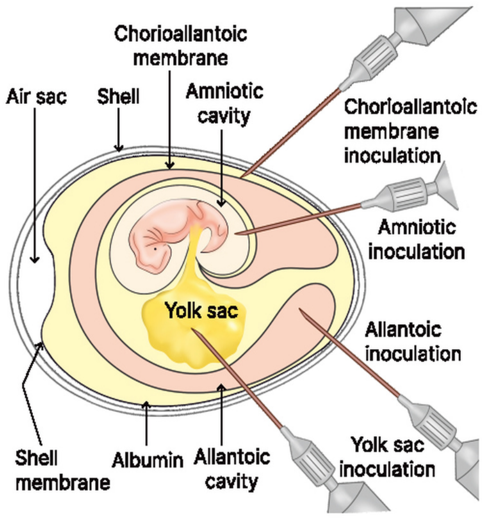
- General rule: All are single-stranded (ssRNA), single copy, and unsegmented.
- Exceptions (Strandedness/Copies):
    - Retrovirus (HIV): Contains two copies of RNA.
    - Reovirus/Rotavirus: Double-stranded RNA (dsRNA).
- Exceptions (Segmentation): "BIRA" viruses
    - Bunyavirus: 3 segments.
    - Influenza: 8 segments.
    - Reovirus/Rotavirus: 11 segments.
    - Arenavirus: 2 segments.

VIRAL CULTIVATION

00:15:49

- Viruses are obligate intracellular organisms and require cells for growth.
- Animal Inoculation:

- Suckling mice are used for Coxsackie virus.
  - → Coxsackie A → Flaccid paralysis in mice.
  - → Coxsackie B → Spastic paralysis in mice.
- Embryonated Egg Inoculation:
  - Chorioallantoic Membrane: Vaccinia, Variola, and HSV-1, HSV-2
  - Yolk Sac: Arbovirus, Chlamydia, and Rickettsia.
  - Allantoic Cavity: Yellow fever, Vaccine preparation of influenza and rabies.
  - Amniotic Cavity: Used for primary isolation of Influenza virus.



- Cell Lines:

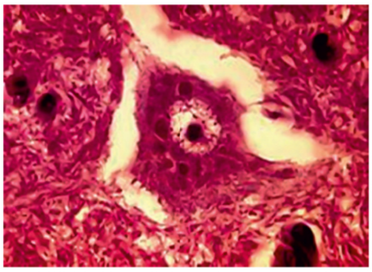
Primary cell lines	Secondary cell lines	Continuous cell lines
5-10 divisions	10-50 divisions	Continuous divisions
• Rhesus kidney cell line • Human Amniotic cell line • Chick Embryo fibroblast	• Human fibroblast cell line ○ CMV ○ MRC5 ○ WI38	• HeLa • Hep-2, KB • McCoy • Vero • Detroit 6 • BHK, Chang C/I/L/K

CYTOPATHIC EFFECTS: INCLUSION BODIES

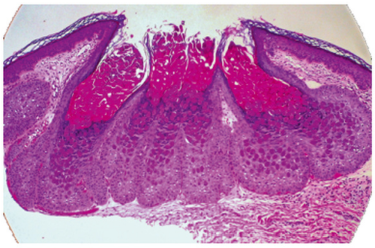
00:22:40

Intracytoplasmic Inclusions

- Negri Bodies: Pathognomonic for Rabies; found in Hippocampus and Cerebellum.
- Paschen Bodies: Variola
- Guarnieri Bodies: Vaccinia.
- Bollinger Bodies: Fowlpox.
- HP (Henderson-Patterson) Bodies: Molluscum contagiosum.
  - Molluscum appears as cup-shaped lesions with pink cytoplasmic bodies.



Negri bodies



HP (Henderson-Patterson) Bodies

Intranuclear Inclusions/Cowdry Bodies

- Cowdry Type A:
  - Lipschütz bodies → Herpes
  - Torres bodies → Yellow Fever
- Cowdry Type B:
  - Adenovirus
  - Poliovirus

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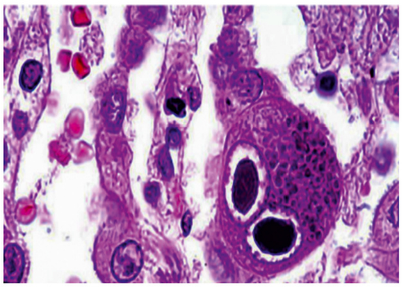
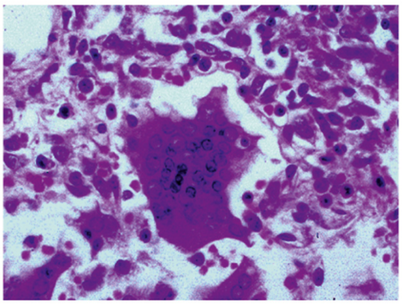
Both Intranuclear And Intracytoplasmic Bodies

• CMV: "Owl's Eye" appearance 	• Measles: Warthin-Finkeldey giant cells. 

DNA VIRUSES

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Herpesviridae Family

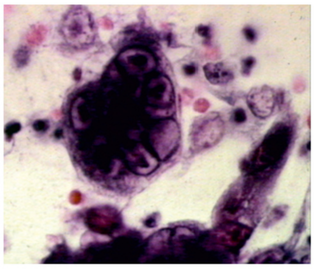
- HHV 1 - Herpes Simplex Virus 1
- HHV 2 - Herpes Simplex Virus 2
- HHV 3 - Herpes Zoster Virus
- HHV 4 - EBV
- HHV 5 - CMV
- HHV 6 - Human Herpesvirus 6
- HHV 7 - Human Herpesvirus 7
- HHV 8 - Human Herpesvirus 8

Herpes Simplex Viruses (Hsv-1 & Hsv-2)

	HSV1	HSV2
Transmission	Mucosa/ Abraded Skin	Sexual/ Vertical
Latency	Trigeminal ganglia	Sacral ganglia
Clinical Features	Skin Lesions above the waist Orofacial Lesions • Most Common Site: Buccal Mucosa • Most Common 1° Lesion: Gingivostomatitis • Most Common Recurrent Lesion: Herpes Labialis Encephalitis • MC cause of acute sporadic viral encephalitis • Temporal Lobe Meningitis	Skin Lesions below the waist Genital Lesions - Painful Vesicles Neonatal Herpes Mollaret Meningitis: Lymphocyte ↑

- Others:
  - Herpetic Whitlow: Vesicles on fingers, Common in healthcare workers (e.g., dentists) touching lesions without gloves.
  - Herpes Gladiatorum: Wrestlers herpes
  - Eczema Herpeticum
  - Erythema Multiforme.

Laboratory Diagnosis And Treatment



- Tzanck Smear: Identification of multinucleated giant cells.
  - Multinucleation.
  - Molding (nuclei fitting into each other).
  - Margination of chromatin.
- Inclusions: Cowdry Type A (Lipschütz bodies).
- DOC: Acyclovir.

Differential Diagnosis Of Genital Ulcers

00:32:35

- Painful Ulcers
  - Chancroid: Haemophilus ducreyi
  - HSV-2: Vesicles
- Painless Ulcers
  - Syphilis: Associated inguinal lymph nodes are also painless.
  - Lymphogranuloma Venereum (LGV): Ulcer is painless, but lymph nodes (Buboes) are painful.
  - Donovanosis: Klebsiella granulomatis; presents as a "beefy red" painless ulcer.

Herpes Zoster / Varicella-Zoster Virus (Hhv-3)

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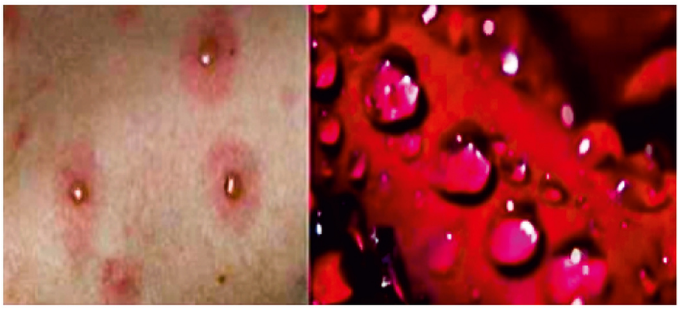
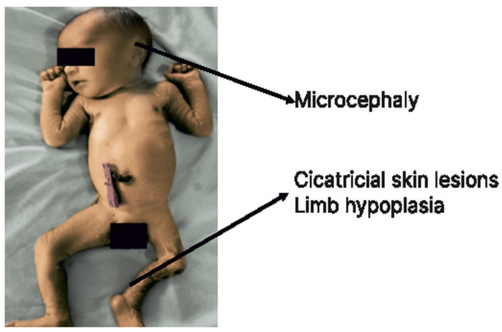


Chicken Pox- Primary Infection

- Incubation period: 14-21 days (2-3 weeks)
- Rash Characteristics
  - Starts on the trunk and spreads outward (flexor surface)
  - Centripetal → Centrifugal
  - Dewdrop on Rose Petal: Vesicle on an erythematous base.
  - Pleomorphic: All stages of rash (papules, vesicles, pustules, nodules) are seen simultaneously.
- Complications:
  - MC: Secondary bacterial skin infection.
  - MC extra-cutaneous: Cerebellar ataxia (benign).
  - Most serious: Varicella pneumonia (Especially in pregnancy).

Congenital Varicella Syndrome



- Mother-to-child transmission →
- Infection within 20 weeks of IUL
  - Microcephaly
  - Cortical Atrophy
  - Limb Hypoplasia
  - Cicatricial Skin Lesion

Herpes Zoster/Shingles (Rectivation Of Varicella Zoster)

- Reactivation of latent virus from ganglia (Geniculate, Trigeminal, etc.) due to old age or ↓ immunity.
- Rash: Painful, unilateral, segmental
- Dermatomal distribution: D3 to L2 (most common)
- Complications:
  - Post-herpetic neuralgia: Persistent pain at the local site after the rash heals.
    → Treatment: Gabapentin.
  - Zoster Ophthalmicus: Eye involvement.
  - Ramsay Hunt Syndrome: Reactivation in the geniculate ganglion.
    → Facial nerve palsy.
    → Vesicles in the external auditory meatus + Otalgia.
    → Loss of taste in the anterior 2/3 of tongue.
- Treatment: Acyclovir

Epstein-barr virus (hhv-4)

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Pathogenesis

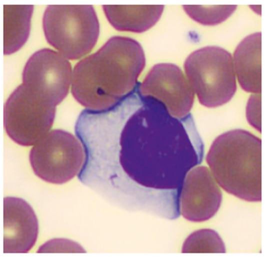
- Target: Attacks B-cells.
- Receptor: Enters via CD21 / Cr2
- Releases:
  - LMP1
  - EBNA2 activates the SRC proto-oncogene → Malignancy.
  - Produces viral IL-10 (Anti-inflammatory)

Clinical Features

- Infectious Mononucleosis: "Kissing Disease" or "Glandular Fever."
  - Fever, lymphadenopathy, hepatosplenomegaly.
- Malignancies:
  - Gastric Carcinoma - MC
  - Nasopharyngeal Carcinoma - 2nd MC
  - Burkitt Lymphoma: Classically seen in African children.
  - Hodgkin Lymphomas
  - Non-Hodgkin Lymphomas: Burkitt lymphoma, DLBCL, Post-transplant T-NHL
  - Leiomyosarcoma (LMS)
- Miscellaneous: Duncan syndrome (lymphoproliferative disorder), Oral Hairy Leukoplakia.

Laboratory Diagnosis And Treatment

- Microscopy: Downey Cells → Atypical lymphocytes found in blood.
  - CD8+ T-cells reacting against the infected B-cells
  - "Ballerina skirt" appearance of cytoplasm.
- Antibody Tests:
  - Heterophile Antibody Tests:
    → Paul-Bunnell test (Old).
    → Monospot test (New).
  - Specific Antibodies: Against EBNA, Early Antigen (EA), or Viral Capsid Antigen (VCA).



- Most sensitive/specific: Nucleic Acid Hybridization (PCR).
- Treatment: Acyclovir (oral hairy leukoplakia), Rituximab

Cytomegalovirus (hhv-5)

General characteristics

- Largest member of the Herpes family.
- Site of Multiplication ("SRK"): Salivary gland, Respiratory tract, Kidney.
- Site of Latency: Monocytes.

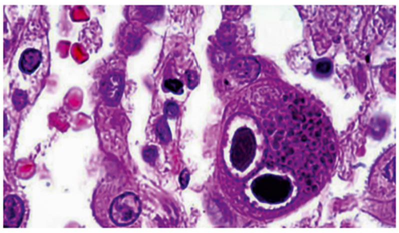
Transmission

- Contact
- Blood transfusion,
- Mother to child - Vertical (Part of TORCH)

Clinical Features

- Congenital CMV: Most severe in the 1st trimester.
  - Sensory Neural Hearing Loss (SNHL) - MC cause of non-genetic SNHL.
  - Chorioretinitis.
  - Microcephaly.
  - Periventricular Calcification.
- Perinatal: Asymptomatic
- Immunocompetent Adults: Usually asymptomatic or infectious mononucleosis-like syndrome.
- Immunocompromised (HIV): CMV Chorioretinitis

Laboratory Diagnosis



- Inclusions: Owl's Eye appearance
  - Intranuclear inclusion + intracytoplasmic inclusions.
  - Reed-Sternberg owl-eye cells (Hodgkin) have red eyes
  - CMV owl-eyes have blue eyes.
- Virus isolation: Human fibroblast cell line.
- Specimen: Urine washings.
- Antigen Detection: PP65 antigen.
- Antibody detection: ELISA
- PCR

Treatment

- Ganciclovir (First-line).
- Foscarnet (if Ganciclovir-resistant).

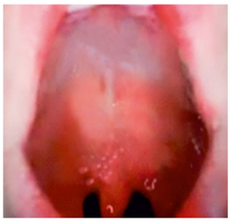
Differential Diagnosis: Brain Calcifications in Neonates

- Toxoplasmosis: Cerebral calcification.
- CMV: Periventricular calcification.
- Zika Virus: Calcification at the grey matter-white matter junction

Yourwish

Human Herpes Virus 6

- Causes Sixth Disease, also known as Roseola Infantum or Exanthem Subitum.
  - Primarily affects infants.
  - High fever
  - Rose-colored/reddish/pinkish rash - non-itchy, non-pruritic papules
  - Nagayama spots are seen in the oral cavity.

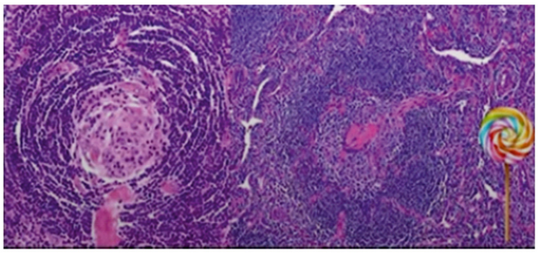




- Two variants: 6A and 6B
- Binds to T-cells via the CD46 receptor.
- Transmission: Primarily through oral secretions, leading to lesions within the mouth.
- HHV-7: Very similar to HHV-6 in characteristics.

Human herpes virus 8 (hhv-8)

Associated diseases

- Kaposi Sarcoma (vascular tumor):
  - Presents as purple-colored nodules or macules.
  - Classically associated with HIV-positive patients.
  - MC site: Skin (thighs or lower limbs).
  - 2nd MC site: Lymph nodes.
- Primary Effusion Lymphoma:
  - Type of Diffuse Large B-cell Lymphoma (DLBCL).
  - Markers: CD30 and CD38 positive.
- Casteman Disease
  - A disease of the lymph nodes
  - Presents with B-cell signs/symptoms: Fever, night sweats, weight loss
  - Histopathology: Onion-skinning appearance:
    → Lymphoid cells arranged in concentric circles around a blood vessel.
  - Lollipop follicles: A blood vessel surrounded by lymphoid cells



Poxviridae

00:56:00

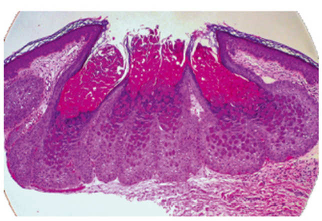
- Smallpox and Cowpox.
  - Smallpox was eradicated in 1980.
  - Smallpox rash is centrifugal (starts at the periphery, moves to the center),

Molluscum Contagiosum

- Lesions are tan-colored and umbilicated (central depression).
- Pressure on the lesion expresses white, dirty, curd-like material.

Histopathology

- Cup-shaped lesion with a central depression
- Contains pink-colored inclusion bodies known as Henderson-Patterson (HP) bodies.
- Special stain: Phloxine-tartarate stain.




Parvoviridae (parvovirus b19)

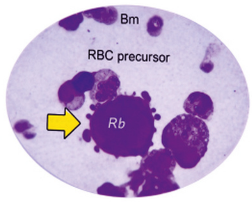
00:57:42
INI CET 2022

General characteristics

- Unique among DNA viruses: Single-stranded DNA.
- Smallest DNA virus (20 nm).
- Spread
  - Respiratory route
  - Blood transfusion
  - Transplacental transmission
- Conditions associated with Parvovirus B19
  - Erythema Infectiosum (5th disease; slapped cheek appearance)
  - Gloves & socks syndrome
  - Arthritis, Arthralgia
  - Aplastic Crisis (in Hemolytic Anemia)
  - Pure red cell aplasia
  - Hydrops Fetalis

Microscopic Findings

- Virus binds to the P-antigen on red blood cell precursors in bone marrow → "dog ear" projections.

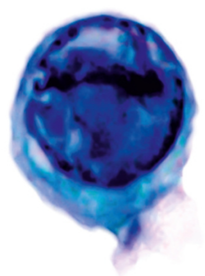


Papovaviridae

01:01:02

Polyomavirus

- Merkel Cell Virus: Causes Merkel cell carcinoma (neuroendocrine skin tumor).
- SV40: Associated with Mesothelioma
- JC Virus: Causes Progressive Multifocal Leukoencephalopathy (PMLE).
- BK Virus: Causes infection in post-renal transplant patients.
  - Results in the formation of Decoy Cells
    → Large cells with very large nuclei found in urine; mimic cancer cells

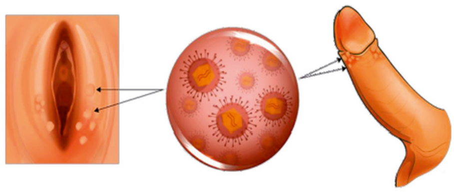


Human Papilloma Virus /Hpv

- Cutaneous Involvement:
  - HPV 1,2,3 (Low risk)
  - HPV 5,8 (High risk)

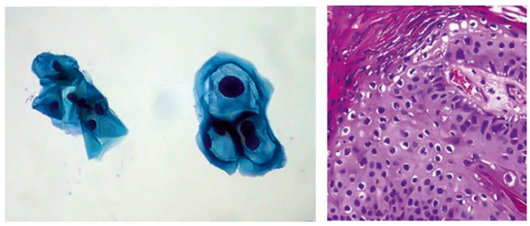
→ Type 5 causes Epidermodysplasia Verruciformis (Tree Man Syndrome)

- Mucosal Involvement:
  - HPV 6,11 (Low risk): Causes genital warts (Condyloma Acuminata).
    → Note: Condyloma Lata is seen in Secondary Syphilis.
  - HPV 16,18,31,33,35 (High risk): Causes Squamous Cell Carcinoma:
    → MC: HPV 16, 18
    → Sites: Cervix, penis, anal canal, head and neck, larynx, esophagus.



Hpv Proteins

- L1 Protein: Major capsid protein; used to make HPV vaccines.
- E2 Protein: Controller; tries to stop cancer progression.
- E4 & E5 Proteins: Form Koilocytes.
  - Cell with a dark "raisinoid" nucleus and a clear perinuclear halo.
- E6 Protein: Inhibits p53 (the "policeman of the genome").
- E7 Protein: Inhibits Rb protein (the "governor of the genome").
  - Inhibition of p53 and Rb → Cancer.



Vaccines

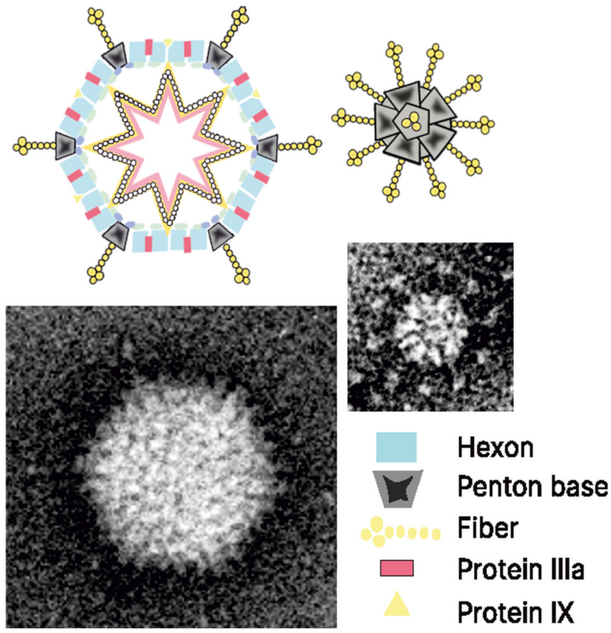
- Bivalent (Cervarix): Targets types 16, 18.
- Quadrivalent (Gardasil): Targets types 6, 11, 16, 18.
- Nonavalent (Gardasil 9): Targets 9 strains.

Adenoviridae

01:09:17

Morphology

- Resembles a spaceship or alien craft.



Clinical Syndromes and Serotypes

- Infantile Diarrhea: Serotypes 40, 41
- Hemorrhagic Cystitis: Serotype 11
- Eye Infections:
  - Serotype 8: Causes Epidemic Keratoconjunctivitis ("Shipyard eye").
  - Serotypes 3, 7, 14: Cause Pharyngoconjunctival Fever (associated with swimming pools).
- Respiratory: Causes upper and lower respiratory tract infections (pneumonia).

VIROLOGY - HEPATITIS

INICET 2024, 2025, FMGE 2021, 2025 01:12:07

Feature	HAV	HBA	HCV	HDV	HEV
Genome	RNA	DNA	RNA	RNA	RNA
Family (Mnemonic: Private Hospitals Favor Rich Clients)	Picornaviridae Enterovirus 72	Hepadnaviridae	Flaviviridae	Relies on HBV	Calicivirus
Mode of infection	Feco-oral	Parenteral, Sexual, MTC	Parenteral		Feco oral route
IP	15-50 days	50-150 days	15-150 days	50-150 days	15-50 days
Envelope	-	+	+	+	-
Cultivable	Yes	No	No	No	No
Vaccine	Yes	Yes	-	-	Yes

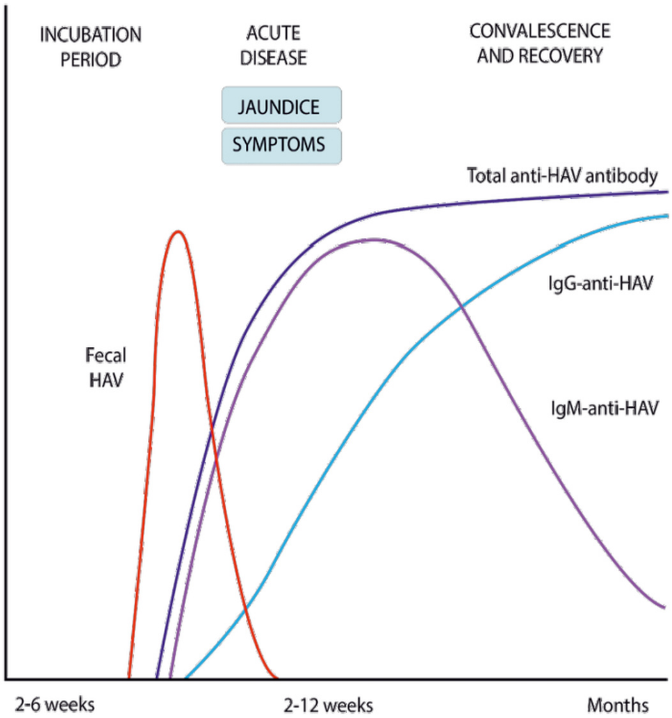
- Hepatitis C → Quasi-species
  - HCV constantly mutates its genome → Difficult to prepare vaccine

Hepatitis G

- Does not cause known human Infection
- Affects mononuclear cells
- Route of transmission: Blood transfusion
- Protects against HIV.

Hepatitis A

- HAV shedding in stool 2 weeks prior to 2 weeks after symptom onset
- IgM appears with the onset of jaundice
- 2-4 weeks later, IgG is seen



Hepatitis B

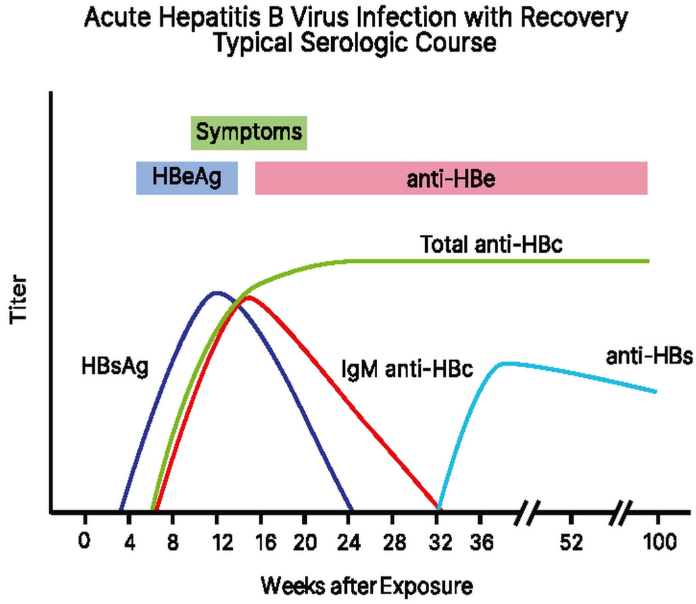
- Structure: 42 nm "Dane particle."
- The genome has genes:

Yourwish

- P Gene: DNA Polymerase.
- S Gene: Surface Antigen (HBsAg), also known as Australia Antigen.
- C Gene: Core Antigen (HBcAg) and Pre-core Antigen (HBeAg).
- X Gene: HBx gene; associated with Hepatocellular Carcinoma (HCC).

HBV Serology

- HBsAg:
  - First to appear
  - Indicates onset of infectivity
  - Epidemiological marker → Anti-HBs
    → >= 10 IU → Immune (vaccinated)
- HBeAg/Precore Antigen:
  - Appears shortly after HBsAg
  - Indicates active infections and high infectivity
  - Anti-HBe - Indicates decrease in infectivity
- HBcAg
  - Not released in the blood
  - Anti-HBc antibody → Present in blood
  - IgM → Marker of window period
    → Between the disappearance of HBsAg and the appearance of Anti-HBs
  - IgG → Seen a few weeks after IgM



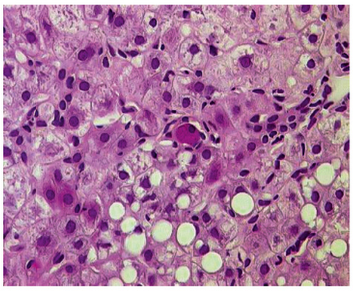
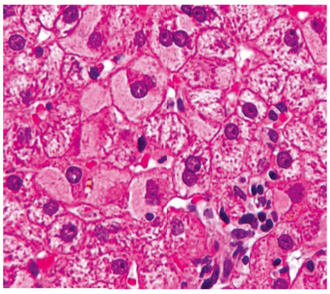
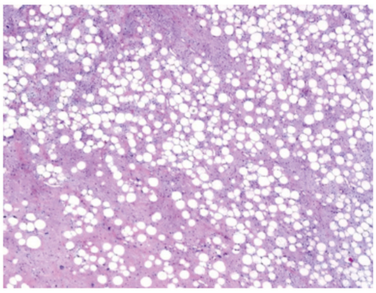
HBsAG	Anti-HBs	Anti-HBc	HBeAg	Anti-Hbe	Interpretation
+	-	IgM	+	-	Acute Hepatitis
+	-	IgG	+	-	Chronic Hepatitis
-	+	+ (IgM + IgG)	-	+	Recovery
-	+	-	-	-	Immunity
-	-	+ (IgM)	-	-	Window period

- M/c/c of sporadic acute Hepatitis in India: Hepatitis E
- M/c/c of fulminant viral Hepatitis: Hepatitis D
- M/c/c of fulminant viral Hepatitis in pregnancy: Hepatitis E
- M/c/c of transfusion-related hepatitis: Hepatitis B
- M/c/c of chronic Hepatitis: Hepatitis B
- Maximum risk and potential for chronicity: Hepatitis C
- M/c/c of carrier state: Hepatitis B
- M/c/c of viral HCC: Hepatitis B
- Most strong association with HCC: Hepatitis C

Biopsy

- Done for Hepatitis B & C → Chronic hepatitis
- Staging → Fibrosis

- Grading → Inflammation, Necrosis

		
• Councilman Bodies (Apoptotic bodies) • Seen in viral hepatitis	• Ground Glass Hepatocytes • D/t HBsAg • Orcein Shikata stain	• Seen in Hepatitis C • Cause fatty liver and lymphoid aggregates

Extrahepatic Manifestations

Hepatitis B	Hepatitis C
• PAN → 30% of HBsAg • MGN	• Mixed cryoglobulinemia • Lichen planus → Colloid/civatte bodies • MPGN

PYQs

01:32:02

Q. An 18-day-old baby presents with fever and cough. On examination, vesicles are observed over the trunk and upper limb. The mother had genital ulcers one year ago, which have since resolved. Biopsy of the vesicles reveals multinucleated giant cells. What is the most likely diagnosis? INI CET May 2023

a. Herpes simplex virus (HSV)
b. Molluscum contagiosum virus (MCV)
c. Human papillomavirus (HPV)
d. Varicella

Answer: a. Herpes simplex virus (HSV)

Q. If a patient's plasma contains elevated levels of interferon beta, it is indicative of a probable infection caused by: INICET Nov 2022

a. Virus
b. Bacteria
c. Fungi
d. Mycoplasma

Answer: a. Virus

- Interferon alpha & beta → Antiviral properties
- Interferon gamma → Granuloma TB

Q. A pregnant woman presents with a history of painful genital ulcers during pregnancy. Her newborn also has similar ulcers. Examination of a smear reveals the presence of Tzanck cells. What is the likely diagnosis? INICET May 2024

a. HSV2
b. VZV

c. HPV
d. Klebsiella.

Answer: a. HSV2

Q. A 13-year-old girl has had 4 episodes of meningitis over the last 4 years, with the disease lasting a few days at a time, slowly resolving neurological symptoms such as visual and memory loss. A CSF cytology shows lymphocytic pleocytosis, and a diagnosis of Mollaret's meningitis is made. Which organism is implicated here?
a. Measles virus
b. Mumps virus
c. Herpes simplex virus
d. Rubella virus

Answer: c. Herpes simplex virus → HSV 2

Q. Match the following viruses with their corresponding nucleic acid type: INICET May 2024

1.	Rotavirus	A. ssRNA
2.	SARS-CoV-2 (COVID-19 virus)	B. dsRNA
3.	Parvovirus	C. dsDNA
4.	Human papillomavirus (HPV)	D. ssDNA

a. 1-C, 2-A, 3-D, 4-B
b. 1-B, 2-A, 3-D, 4-C
c. 1-B, 2-C, 3-D, 4-A
d. 1-D, 2-A, 3-B, 4-C

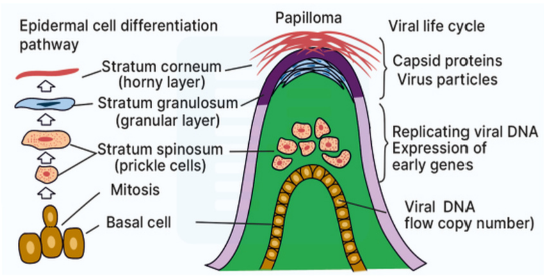
Answer: b. 1-B, 2-A, 3-D, 4-C

Q. A child presents with fever and rash. Urine examination shows cells with an "owl-eye" appearance. What is the most likely diagnosis?
a. Cytomegalovirus
b. Epstein-Barr virus
c. Herpes simplex virus
d. Toxoplasma gondii

Answer: a. Cytomegalovirus

INICET Nov 2025

Q. Which of the following is true regarding the virus in the image:
a. RNA virus
b. Oncogenic virus
c. The vaccine is not available
d. The most common manifestation is a painful genital ulcer



Answer: b. Oncogenic virus

2. VIROLOGY PART 2 - RNA VIRUSES

MYXOVIRUS

00:00:20

- Orthomyxovirus
  - Influenza A, B, C
- Paramyxovirus
  - Measles
  - Mumps
  - Human RSV
  - Para-influenza
  - Nipah virus

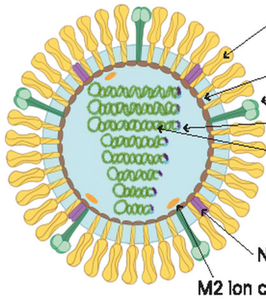
Important Information
- Earlier, Rubella belongs to the family of Togavirus
- Now Rubella belongs to the family of Matonaviridae

Orthomyxovirus

00:01:21

Influenza

Structure



- Surface
  - Hemagglutinin (HA) → Entry
  - Neuraminidase (NA) → Exit
- Core → Has 8 RNA segments
- Matrix protein
  - M1
  - M2 → Ion channels
    - → Helps in the uncoating of the virus in the host
    - → Amantadine and Rimantadine are M2 Inhibitors

Antigenic variations
- 2 types
  - Antigenic shift
  - Antigenic drift

Antigenic shift	Antigenic drift
• Sudden change	• Gradual change
• Occurs due to exchange of RNA segments between influenza A → Genetic Reassortment	• Occurs due to mutation in the H and N receptors

Yourwish

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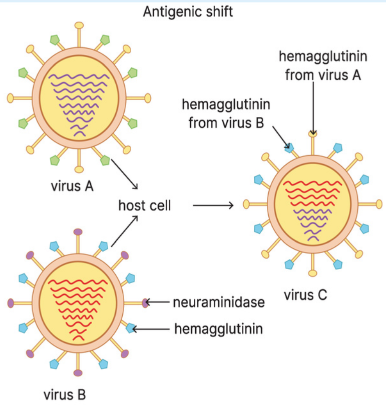
<td>
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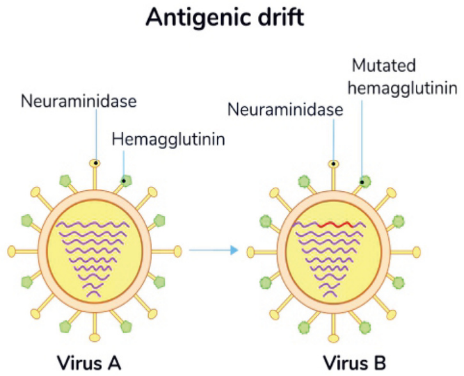
<td>
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<tr>
<td>• Cause major epidemics and pandemics</td>
<td>• Cause seasonal flu</td>
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<tr>
<td>• Seen in influenza A</td>
<td>• Seen in influenza A and B</td>
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</table>

Clinical features

- Fever
- Headache
- Sore throat
- Cough
- Myalgia
- Involvement of the lower respiratory tract → leads to Pneumonia

Laboratory diagnosis

- Specimen → Nasopharyngeal swab
- Test → Hemagglutination Inhibition test

Treatment

- Neuraminidase inhibitors
  - Tamiflu / Oseltamivir → given by Oral route
  - Relenza / Zanamivir → given by Inhalational route
- M2 inhibitors
  - Amantadine
  - Rimantadine

Paramyxovirus

00:07:44

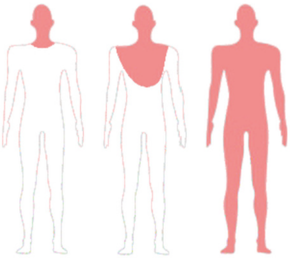
Measles virus

NEET PG 2023

- a/k/a Rubeola
- Incubation period is 10 days
- Strain used in the vaccine → Edmonston Zagreb strain

Clinical features

Duration	Features
Day 10	• Fever • 3C → Cough, Coryza (Runny nose), Conjunctivitis

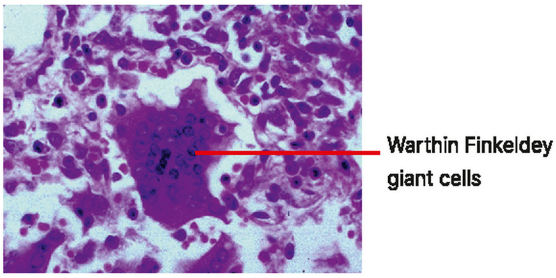
Day 12	• Koplik spots → occur opposite the molar teeth • Pathognomic 
Day 14	• Rash → appears behind the ear and spreads downwards 

Complications

- Pneumonia → Hecht's pneumonia
- SSPE (Subacute Sclerosing Pan-encephalitis)
    - Late complications
    - Occurs after 7 - 10 years of development of measles
    - Fatal

Microscopy

- Warthin Finkeldey Giant cell
    - Intranuclear and Intracytoplasmic Inclusions

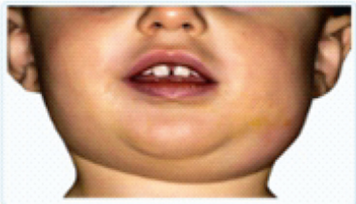


Mumps

- Incubation period is 19 days
- Strain used in the vaccine → Jeryl Lynn strain

Clinical features

FMGE Jan 2023



- Most commonly, mumps as inapparent manifestations
- MC manifestations → Bilateral parotitis
- Second MC manifestation → Unilateral orchitis
- Aseptic meningitis
- Atypical mumps → features of meningitis occur without parotitis

Differential diagnosis

- Warthin's tumor
    - Occur in adult

- H/O smoking
- B/L parotid enlargement

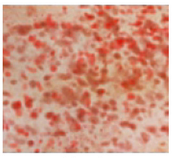
Rubella

FMGE Jan 2025

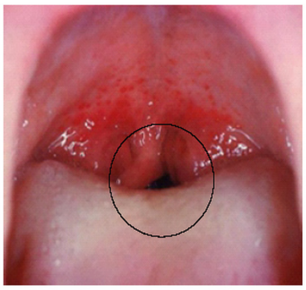
- a/k/a German measles / 3-day measles
- Rubella belongs to the family of Matonaviridae, not Paramyxoviridae
- The incubation period is 14 days
- Strain used in the vaccine → RA 27/3

Clinical features

- Rash
- Forschheimer's spot
  - Non - specific
  - Appears on the palate
- Congenital Rubella Syndrome: Mother-to-child transmission
  - Blueberry muffin
  - SNHL
  - PDA
  - Cataract
  - Retinopathy
  - Rubella virus is excreted in the saliva and urine of the child

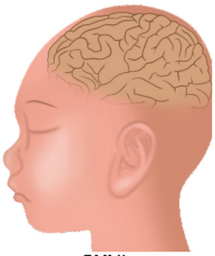


Rash

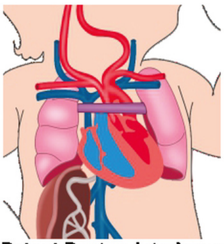


Forschheimer's spot on palate

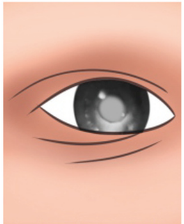
Blueberry muffin syndrome



SNHL



Patent Ductus Arteriosus



Cataract

Respiratory syncytial virus (rsv)

- LRTI → MC in children
- URTI → MC in adults
- Common during the rainy season
- Mutinucleate giant cells → Cells are arranged in groups

Nipah virus

NEET PG August 2024
FMGE June 2024

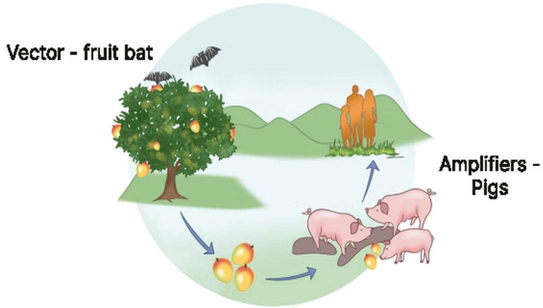
- Outbreak occurred in Kerala around 2018
- Mortality is 60-70%

Clinical features

- Encephalitis
- Fever

Life cycle

- Fruit → Date palm sap
- Vector → Fruit bat
- Transmission
  - Bat's urine → contaminating food and water
  - Pigs
  - Person-to-person transmission → through secretions



PICRONAVIRIDAE

00:21:06

- It has 2 groups
  - Enterovirus → Feco-oral route of transmission
    - → Polio
    - → Coxsackie
    - → Enterovirus
    - → ECHO virus
  - Rhinovirus → Inhalational route of transmission
    - → Binds to ICAM of the respiratory mucosa

Important Information

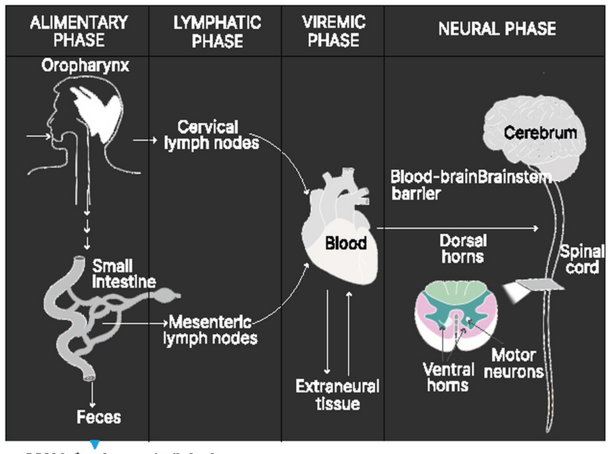
- Plasmodium falciparum attaches to ICAM of the cerebral vasculature

Poliovirus

Pathogenesis

- Alimentary phase
  - Feco-oral transmission
  - Enters the Lymphatic channel
- Lymphatic phase
  - Virus enters the Cervical and Mesenteric lymph nodes
  - Lymphatic channels drain into blood vessels
- Viremic phase
  - Virus enters the Blood and reaches the neural tissue
- Neural phase
  - Affect the Brain

Feco-oral route



90% infection- subclinical

Investigations

- Throat swabs
- Rectal swabs / Fecal samples
- Sewage sample → assess the burden of disease in the community

Coxsackie virus

INICET May 2025

Type	Coxsackie A	Coxsackie B
Serotypes	1-24	1-6

Yourwish

Features	• Herpangia • Hand-foot-mouth disease • Acute Hemorrhagic Conjunctivitis ○ Caused by Coxsackie A24 / Enterovirus 70	• Carditis • Hand-foot-mouth disease • Bornholm's disease / Pleurodynia / Devil's grip / Epidemic myalgia
Demonstration → By injecting into suckling mice	• Flaccid paralysis	• Spastic paralysis

RHABDOVIRUS

00:27:04

- 2 genus
  - Lyssavirus → Rabies
  - Vesiculo virus → Vesicular stomatitis virus

Rabies

Pathogenesis

H/O Dog bite

↓

Viral inoculation and replication occur in the muscle.

↓

Binds to the acetylcholine receptor

↓

Retrograde axonal transport

↓

Spreads centripetally along the peripheral nerves and reaches the
dorsal root ganglion of the spinal cord

↓

Reaches brain

↓

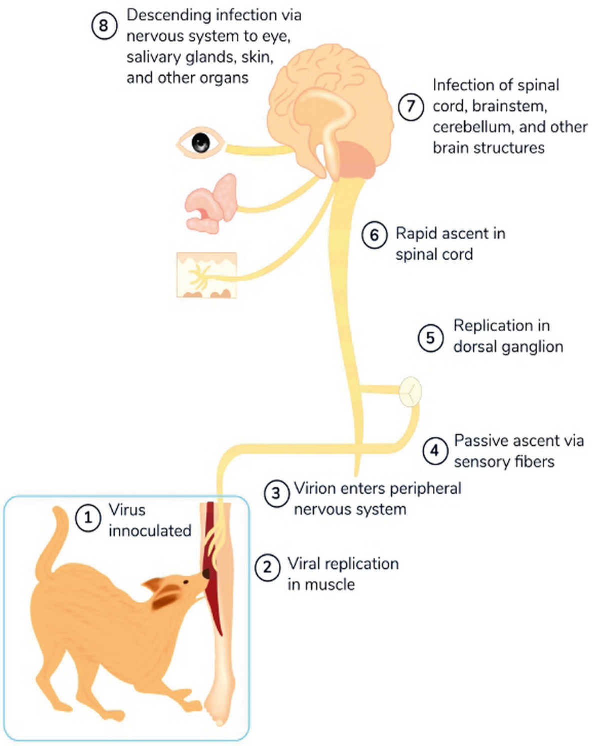
Formation of Negri bodies in the hippocampus and cerebellum

↓

Then spreads centrifugally via nerves.

↓

Reaches Cornea, Salivary gland, skin



Clinical features

- Spreads of the rabies virus progress in the axon at a speed of 3 mm/hr
- Symptoms occur within a shorter period of time in the following conditions:
  - Children
  - Upper limb bite
  - Short height

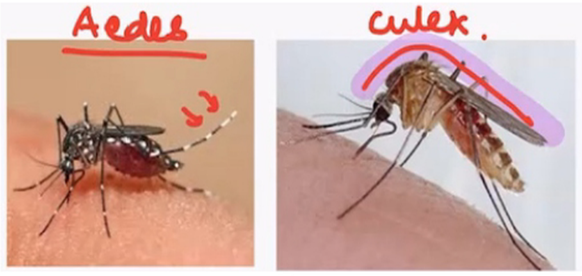
Diagnosis

- Best sample → Hair follicle at the nape of the neck
- Antigen tested by Direct Immunofluorescence / Direct Fluorescence testing
- Autopsy → Negri bodies are stained with Seller's stain

ARBOVIRUS

00:31:27

- Arthropod-borne viruses
- Arthropods included are Aedes, Culex, and Tick



Arthropods	Disease transmitted
Aedes aegypti	• Eastern Equine Encephalitis • Zika virus • Chikungunya • Rift Valley fever • Yellow fever • Dengue
Culex	• Japanese encephalitis • Wuchereria bancrofti filariasis • West Nile fever

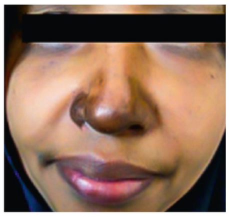
Classification

	Description
Bunya virus	• Has 3-segment RNA
Toga virus	• Rubella virus → Now, belongs to the family of Matonaviridae • Chikungunya virus • Eastern Equine Encephalitis (EEE) • Western Equine Encephalitis (WEE)
Flavivirus	• Japanese Encephalitis • Yellow fever • Zika virus • Dengue • Hepatitis C virus • West Nile fever

Reoviridae	• Colorado tick fever
Rhabdoviridae	• Vesicular stomatitis virus

Chikungunya

- Incubation period is 5-6 days
- Clinical features
  - Fever
  - Migratory polyarthritis / Arthalgia
  - Chick sign → Pigmentation over the nose



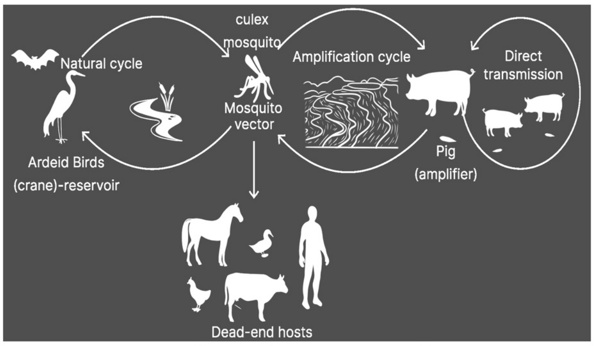
Chik sign

Yellow fever

- Incubation period is 3-6 days
- Clinical features
  - Fever
  - Jaundice → Due to Midzonal necrosis in the liver
  - Torres bodies
- Vaccine
  - Live attenuated vaccine
  - Strain used is 17D
  - Vaccine is C/I in Immunodeficient individuals and those with allergic to egg.
  - Certificate given after 10th day of vaccination and is valid lifelong
  - India is free of yellow fever
    → Aedes aegypti index < 1 in the seaport and airport

Japanese encephalitis

- Incubation period is 5-15 days
- Life cycle
  - Vector → Culex tritaeniorhynchus, Culex vishnui (India)
  - Reservoir → Ardeid birds
  - Amplifier → Pig
  - Accidental host / Dead-end host → Humans
- Vaccine



Life cycle of Japanese encephalitis

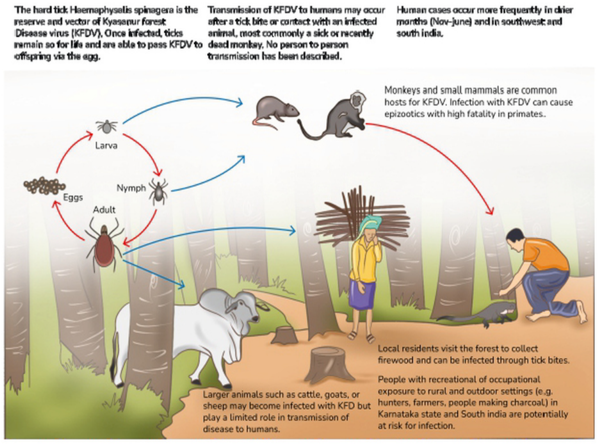
Live attenuated	Inactivated

• Strain → SA 14-14-2
  ○ 2 doses given through the SC route
  ○ Most commonly used in India
	• Nakayama & Beijing P1 strain
	• Jenvac
	  ○ Killed Kolar strain
	  ○ 2 doses given through the IM route

Dose 1: 9 months Dose 2: 16 - 24 months	

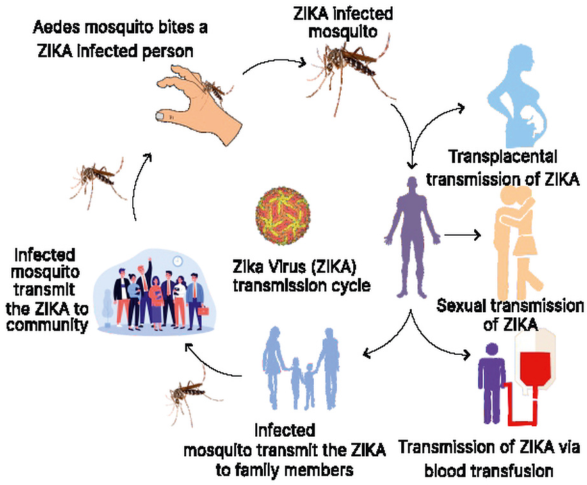
Yourwish

Kyassanur forest disease

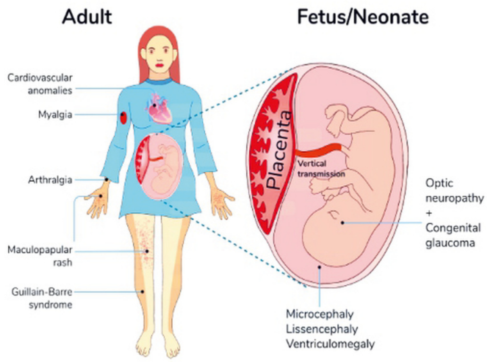


- a/k/a Monkey fever
- Incubation period is 4-8 days
- Vector → Hard tick
- Amplifier → Monkey
- Transmission
  - Direct bite by the Tick
  - Contact with monkey that is bitten by tick
  - No person-to-person transmission

Zika virus



- Vector → Aedes
- Zika-infected mosquito bite → humans
- Transmission in humans:
  - Sexual transmission
  - Transplacental transmission
  - Blood transfusion
- Clinical features
  - Myalgia
  - Joint pain
  - Rash
  - Guillain-Barré syndrome
- Congenital Zika virus transmission
  - Macrophage of placenta → Hofbauer cells are affected
  - Microencephaly
  - Optic neuropathy
  - Congenital glaucoma



FMGE June 2021

Dengue virus

- 4 serotypes: DEN 1-4
- Most dangerous → DEN 2
- New serotype is being identified from Bangkok in 2013 → DEN 5
- Vector → Aedes
- Laboratory diagnosis
  - Decreased platelet count
  - Increased Hematocrit → due to plasma loss
  - NS1 antigen → Detected on Day 1 - 5
  - IgM → Detected through ELISA after Day 5
  - RTPCR

Important Information

- NS1 Ag → Dengue
- RK 39+ → Kala azar / Leishmaniasis
- Og4C3 Ag → Filariasis

Yourwish

REOVIRIDAE

00:47:01

Rota virus

- Shape of the virus → Wheel shape
- Feco-oral route of transmission
- Incubation period is short
- Virulence factor / Toxin
  - NSP4 (Non-structural protein 4) → Enterotoxin
- MC cause of Diarrhoea in children → Rotavirus
- Investigations
  - Sample taken is stool
  - Antigen detection
  - PCR
- Vaccine
  - Rotateq , Rotarix
  - Side effect → Intussusception

Important Information

- Peutz-Jeghers syndrome
  - Intussusception
  - Christmas tree polyp
  - Pigmentation around mouth
- Bat → Ebola
- Fruit bat → Nipah virus

FILOVIRIDAE

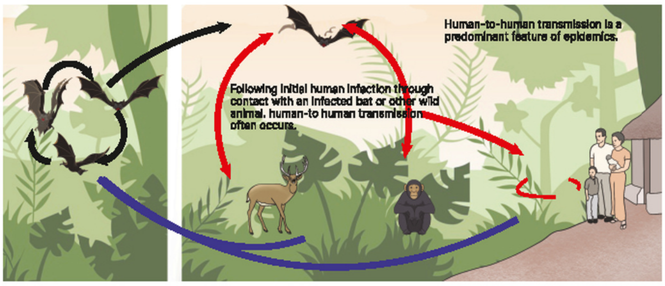
00:48:44

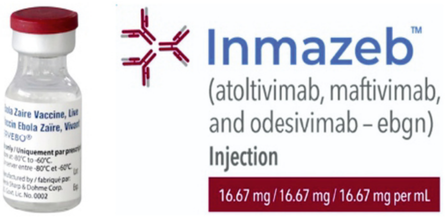
Marburg virus

- Cause Hemorrhagic fever

Ebola virus

- Endemic in Africa
- Shape → Filamentous (Bowel of spaghetti)
- Incubation period is 3-15 days
- Vector → Bat
- Transmission
  - Direct contact of bat with humans
  - Contact of ebola virus infected animal with human
  - Person-to-person transmission → Spread through secretion
- Most virulent → Zaire ebola
- Least virulent → Ivory Coast
- Not known to cause disease → Reston
- Vaccine : Zaire vaccine
- Immunoglobulin
  - Inmazeb → Injection monoclonal antibody of Zaire ebola





Yourwish

RETROVIRUS

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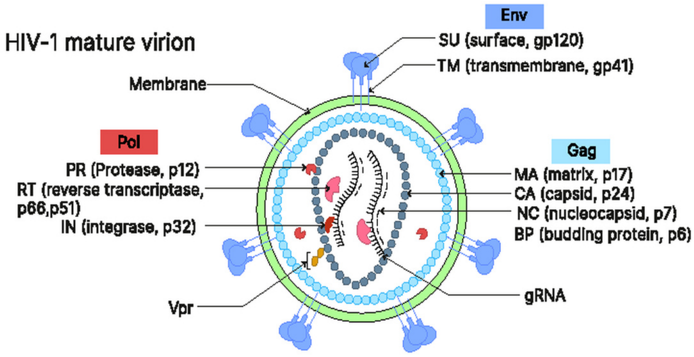
INICET May 2023

Hiv

- Types
  - HIV 1
  - HIV 2
- MC in India: HIV 1 group M and subtype C



Structure

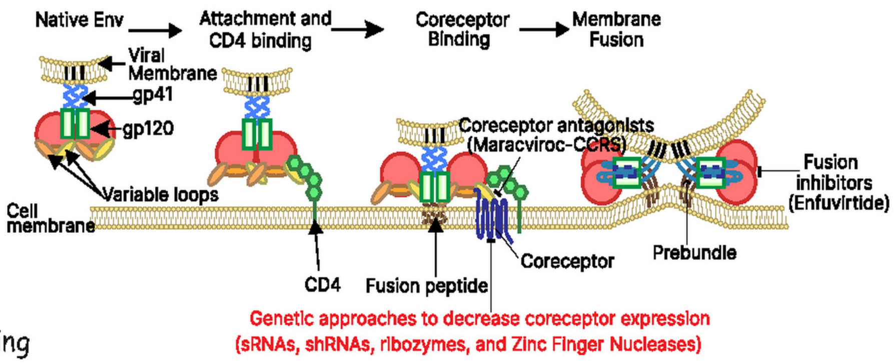
- 2 copies of RNA
- Structural genes
  - Env
  - Gag
  - Pol

Structural genes	

Env	• gp 160
	  ○ gp 120 → Surface
	  ○ gp41 → Transmembrane

Gag	• P6, P7, P17, P24
Pol	• Reverse transcriptase • Integrase • Protease

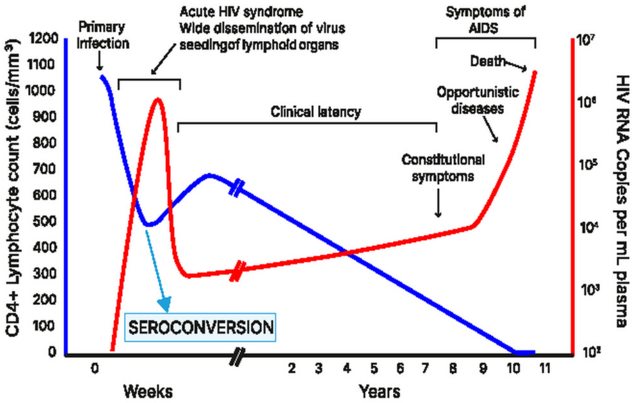
Pathogenesis



- Co-receptor binding
  - gp 120/41 → CD4 T cell
  - Chemokine receptor binding → CXCR4 in CD4 T cell / CCR5 in macrophages

Clinical features

- Primary infection
- Acute HIV syndrome
  - Wide dissemination of virus seedings of lymphoid organs
  - Fever, cough, body pain
- Clinical latency



- Non - microbiological latency → Test for HIV is positive
- Symptoms of AIDS
  - Constitutional symptoms
  - Opportunistic infections

CD4 cell count	Opportunistic infections
< 600	• Swelling of lymph nodes
< 500	• Herpes zoster virus
≈ 400	• Kaposi sarcoma
≈ 300	• Oral hairy leukoplakia • TB
< 200	• Pneumocystis pneumonia • Candida • Cryptosporidium • Mucocutaneous herpes • Miliary TB
< 100	• Cerebral toxoplasmosis • Cryptococcal meningitis • CNS lymphoma • PMLE • HIV associated dementia
< 50	• CMV retinitis • MAC

Lung infection in hiv

CD4 count	Lung infection and X-ray findings

< 500	• Pneumococcus
	  ○ Lobe consolidation
	  ○ Caused by Streptococcus pneumoniae
	• TB
	  ○ Snowstorm / hazy pattern

< 200	• Pneumocystis pneumonia ○ Perihilar opacities

Investigations

Screening → elisa

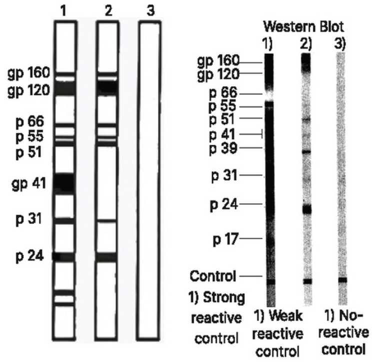
- A total of 5 generations are present
- 4th Generation assays
  - Detection of P24 antigen
  - More sensitive

1st generation Assays (EIAs)	2nd generation Assays	3rd generation Assays	4th generation Assays	5th generation Assays
• Viral hysate antigen	• Peptides/recombinant proteins as antigens • Includes HIV-2	• Sandwich format • Detects IgM + IgG antibodies • Include HIV-1, 2, and group O	• Detection of p24 Ag + antibodies: More sensitive chemilumine scence detection	• Multiplex format • Detection of p24 Ag. HIV-1 and HIV-2 distinguished, all in one assay

Confirmatory (western blot) INICET Nov 2021

- Principle → Immunoblot technique
- WHO criteria
  - Presence of ≥2/3 env antibodies (gp160/120/41) with or without gag/pol bands
- CDC criteria
  - Presence of any 2 bands (P24, gp160, gp120, gp41)

Interpretation



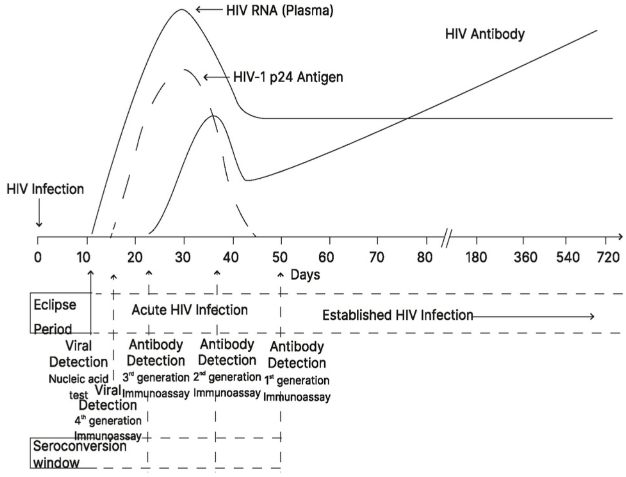
gp 160+ , gp 120+ , gp 41 +	• Strongly positive
gp 160+ , gp 120+	• Positive
gp 160 - , gp 120 - , gp 41 -	• Negative

Yourwish

Immunofluorescence assay	**HIV-1 Western blot**	**Line or dot Immunoassays**
• Fixed infected cells	• Very specific • Nitrocellulose strips with separated viral proteins • Specific banding pattern indicative of HIV infection	• Recombinant peptides or proteins stripped on a membrane • Include HIV-2 peptides • Examples - InnoLIA, Multi-spot, Geenius

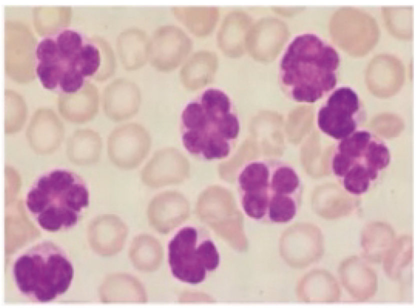
Needle stick injury

- Test
  - Earliest → HIV RNA+
  - p24 +
- Chance of infection
  - HBV → 30%
  - HCV → 3%
  - HIV → 0.3%



Htlv - 1

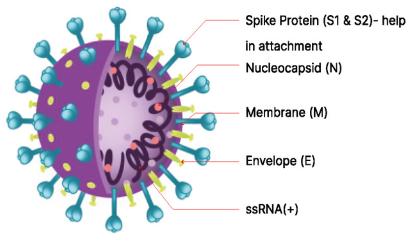
- Human T-cell leukemia lymphoma virus
- Tax gene
- Causes
  - ATLL → Adult T-cell leukemia lymphoma
  - Tropical spastic paraparesis
- Mode of transmission
  - Blood
  - Body fluids
- Microscopically → Clover leaf cells



COVID-19

FMGE Dec 2021 01:08:49

- a/k/a SARS CoV2 / WUHAN virus
- Family → Coronaviridae
- Genus → Beta coronavirus
- Structure
  - Crown shape
  - Petal-like peptomer → Spike protein, which helps in attachment
- Attachment



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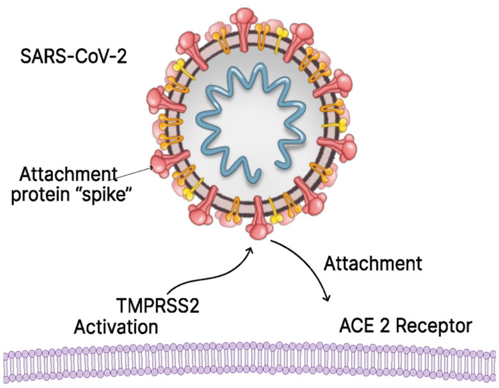
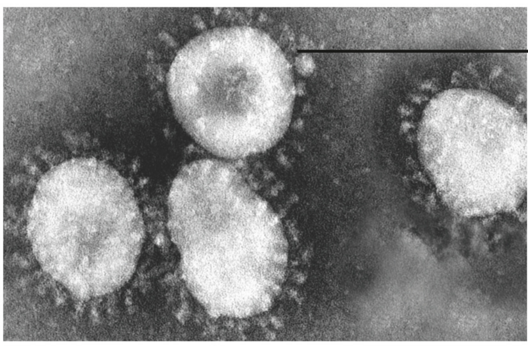




Petal like peplomers - Spike proteins

Electron microscope appearance

TMPRSS2 gene present in host

↓

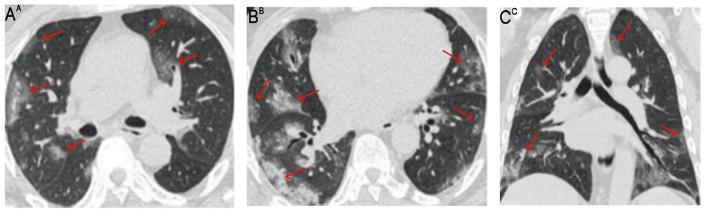
Activate spike protein

↓

Binds to ACE 2 Receptor

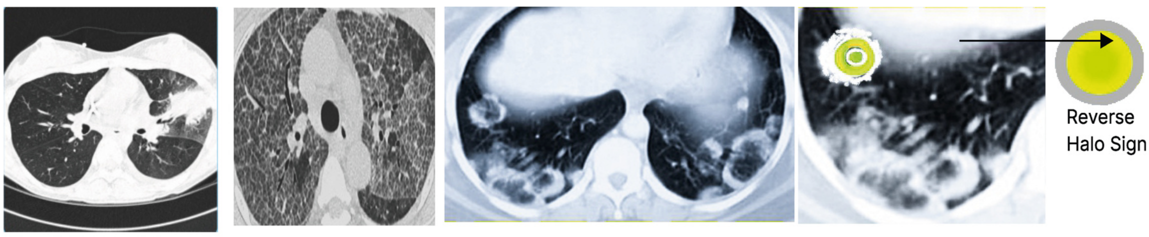
Clinical features

- Fever
- Dyspnea
- Dry Cough
- Shortness of Breath
- Anosmia → Loss of smell
- GI Complaints → Nausea, Vomiting, Pain, Diarrhoea
- Myalgia
- Coagulopathy



Radiological findings

- Multifocal Ground glass opacities → MC radiological findings
- Crazy pavement pattern
- Consolidation
- Reverse halo sign / Atoll sign
  - Outside → Consolidation
  - Inside → GGO



Diagnosis

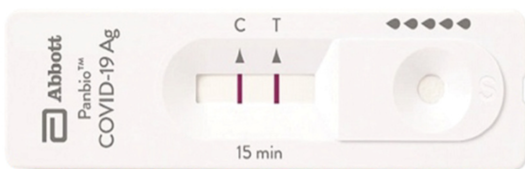
- Sample → 1 nasopharyngeal swab and 1 oropharyngeal swab
- Transport media → Viral transport media

Rrtpcr (real time reverse transcriptase pcr)

- Presence of genes RdRP and ORF1a → Confirmatory
- Presence of genes E , N , S → Semi confirmatory
- Quantification is done
- Measures cyclical threshold (CT)

Card test

- Principle → Immunochromatography
- Control line → Validity
- Test line → Result



ANTIVIRAL DRUGS

01:16:26

Virus	Drugs

Herpes simplex virus 1
Herpes simplex virus 2
Herpes zoster virus
	• Acyclovir
	• Resistant cases
	  ○ Fosarnet
	  ○ Cidofovir

CMV	• Ganciclovir
	• Resistant cases
	  ○ Fosarnet
	  ○ Cidofovir

CMV Retinitis	• Intravitreal Ganciclovir
Smallpox → Eradicated	• Brincidofovir
Monkey pox / TPOXX	• Tecovirimat

Influenza	• NA inhibitors
	  ○ Oseltamivir → Oral route
	  ○ Zanamivir → Nasal route
	  ○ Peramivir
	• M2 inhibitors
	  ○ Amantadine
	  ○ Rimantadine

RSV	• Ribavirin • Prophylaxis → Pavilizumab

PYQs

01:18:20

Q. Match the following viruses with their corresponding nucleic acid type: INICET May 2024

1. Rotavirus	A. ssRNA
2. SARS-CoV-2 (COVID-19 virus)	B. dsRNA
3. Parvovirus	C. dsDNA
4. Human papillomavirus (HPV)	D. ssDNA

a. 1- C, 2- A, 3- D, 4- B
b. 1- B, 2- A, 3- D, 4- C
c. 1- B, 2- C, 3- D, 4- A

d. 1- D, 2- A, 3- B, 4- C

Ans: b

Q. In patients affected by COVID-19, which of the following patterns is frequently observed in chest CT scans?
FMGE Dec 2021
a. Interlobular septal thickening
b. Air bronchograms
c. Ground glass opacity
d. Crazy paving pattern

Ans: c

Q. Which of the following molecular analysis methods is used to detect RNA? INICET Nov 2021
a. Sanger's method
b. G banding
c. Western blot
d. RT-PCR

Ans: d

- Sanger's method used to detect DNA

Q. Which of the following causes acute hemorrhagic conjunctivitis:
1. Polio virus
2. Coxsackie A
3. Coxsackie B
4. Enterovirus 70
a. 1,2,3
b. 2,3,4
c. 1,3,4
d. 2, 4

Ans: d

Q. A child presents with fever and a rash spreading from the face, behind cheeks and buccal mucosa to other body parts. On examination, Koplik's spot is present. What is the likely diagnosis?
a. Measles
b. Rubella
c. Varicella
d. Mumps

Ans: a

- Incubation period of measles → 10 days
- Incubation period of mumps → 19 days
- Incubation period of rubella → 14 days

Yourwish

2. MYCOLOGY

STRUCTURE

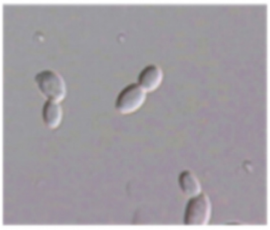
00:00:15

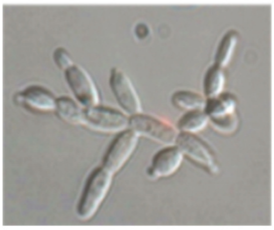
Cell Wall

- Made up of chitin
- Cell membrane made of ergosterol
  - Pneumocystis carinii no ergosterol

FMGE 2021

Classification Based On Morphology





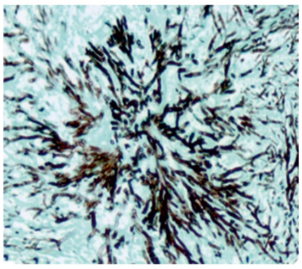
- **Yeast**
  - Budding is present
  - cryptococcus
- **Yeast-Like**
  - Budding+ pseudohyphae
  - candida,malassezia
- **Mold/Hyphae**
  - Aspergillus,mucor
  - True hyphae present
- **Dimorphic Fungus**
  - Has 2 morphologies
  - Temperature dependent
    - → 37 degree→yeast form
    - → 22-25 degree→mold/hyphae

FMGE 2020

Classification-Based On Location

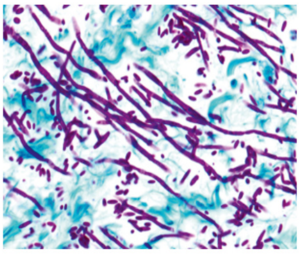
- Superficial mycosis
  - Affects skin
    - → Tinea versicolor/malassezia furfur
    - → dermatophytes/tineasis
- Subcutaneous mycosis
  - Mycetoma
  - Rhinosporidiosis
  - Chromoblastomycosis
  - Sporotrichosis
- Deep mycosis/systemic mycosis
  - Dimorphic fungus
  - Zygomycetes
  - Aspergillus
  - Candida
  - Cryptococcus

Gms



- Gomori methemine silver stain
- Always give black color

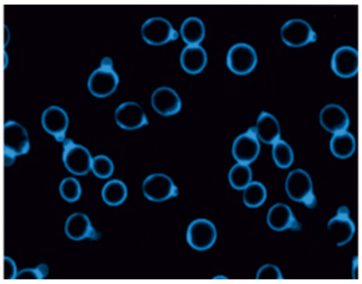
Pas



- Gives pink color

Calcofluor White (Cfw)

- Binds to chitin
- Used in fluorescent microscope
- outline/cellwall becomes colorful



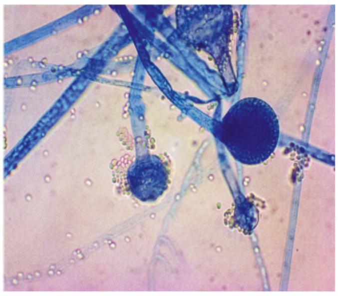
NEET PG 2022

Culture Media

- Sabouraud's dextrose agar
- pH-5.6
- Add gentamicin and chloramphenicol to prevent bacterial growth

On Microscopy

- Stain used lactophenol cotton blue →blue color to the fungus
- Add glycerol for hygroscopic action



TINEA VERSILCOLOR

00:06:20

FMGE 2021

- Caused by malassezia
  - Malassezia globosa> malassezia furfur

Clinical Features

- Hypopigmented lesions

Investigations And Diagnosis

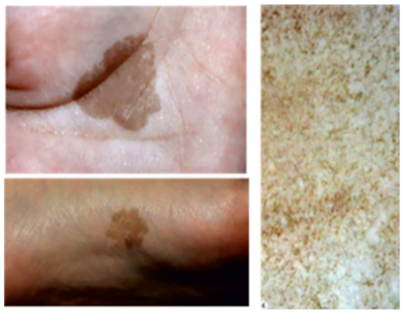
- Skin scraping in KOH mount(10% used)
  - Removes keratin
  - Fungus -spaghetti and meatball appearance /banana and grapes appearance

- SDA with olive oil (lipopholic organism)
  - Fried egg colonies

Treatment

- Eat and put azoles-mnemoninc
- Topical cream
  - Sulfur ointment can be used
  - 1%-2% imidazole creams
- Systemic
  - Itraconazole
  - Fluconazole

NEET PG 2021



Tinea Nigra

- Tinea -hair and skin
- Nigra-brown color
- Causes brown color lesions on the palm,sole,microscopically also brown

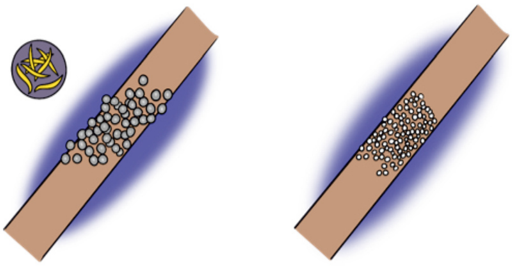
Etiology

- Organism caused is hortae werneckii

Treatment

- Topical azoles used

FMGE 2020, 2023



Piedra

- Hair infections are called piedra
- White and black color fungus present
- Black piedra→piedra hortae
- Whitepiedra→trichosporon beigeli

Treatment

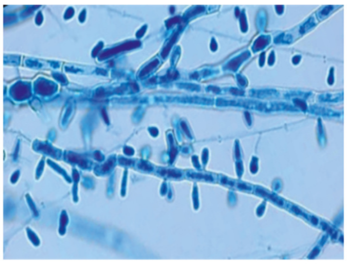
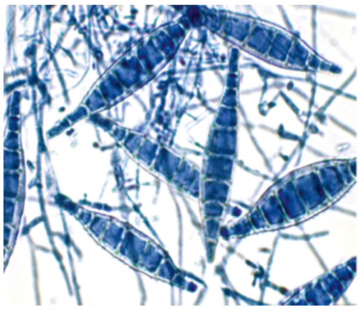
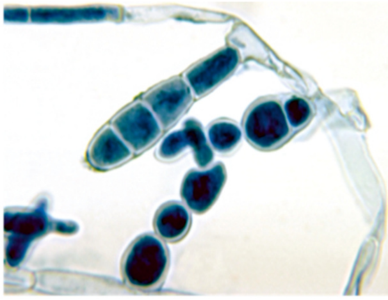
- azoles topical used
- Shaving of the hair

Dermatophytosis/Tineasis

NEET PG 2022

- commonly called ringworm infection
- Includes
  - Trichophyton→skin,hair,nail affected
  - Microsporum→skin ,hair affected
  - Epidermophyton→skin and nail affected

Yourwish

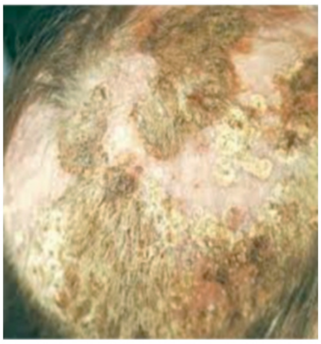
Organism	Macroconidia	Microconidia
Trichophyton 	Pencil shaped +	+++
Microsporum 	Spindle shaped+	++
Epidermophyton 	Club shaped+	+/-

Tinea Capitis

- Affects the scalp

Tinea Faciel/Scutula

- White crusting visible
- Caused by T. schoenleinii



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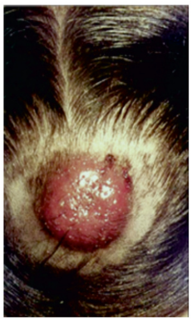
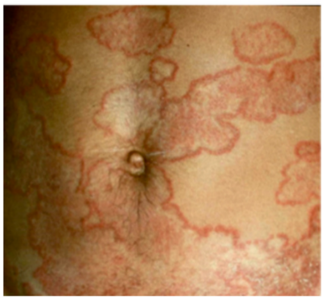


Kerion

- Boggy swelling in the scalp

Tinea Corporis

- Trunk is involved

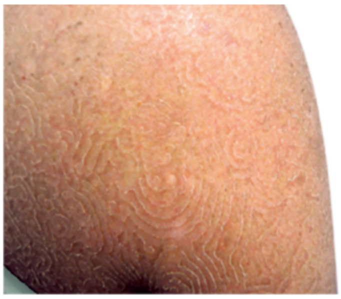


Tinea Unguam

- Nail bed involvement

Tinea Imbricata

- Concentric arrangement of lesions



Other Infections

- **Tinea barbae**
  - Involves the beard
- **Tinea facial**
  - Involves the face
- **Tinea cruris**
  - Involves the groin
  - Occurs in moist situation
  - a/k/a dhobi itch/jock itch
- **Tinea pedis**
  - a/k/a athletes foot

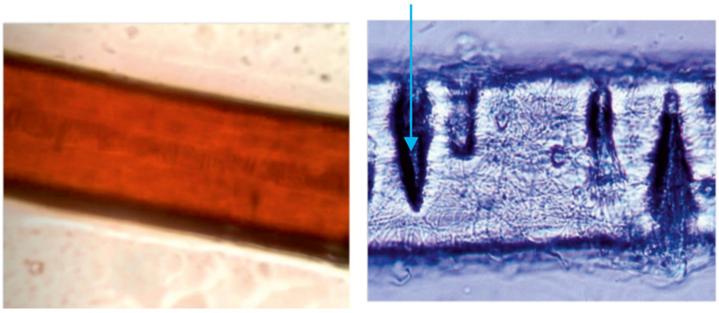
Yourwish

FMGE 2022
INICET 2024

Hair Perforation Test

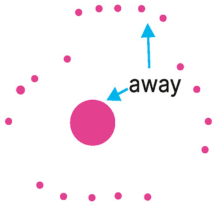
- Incubate hair with yeast and fungus with 2-3 weeks
- T.mentagrophytes shows hair shaft erosion

Wedge shaped perforations



Negative Positive

Dermatophytids/Id Reaction



- Sterile lesions away from the original lesions
- Fungus released products from main lesions and caused lesions elsewhere
  - On giving antifungal medicines fungal products are released

MYCETOMA

00:18:30

- a/k/a madura foot
- Foot has sinuses from which pus is coming out
- Caused by bacteria /fungus
  - Bacteria→actinomycetoma
  - Fungus →eumycetoma

Treatment

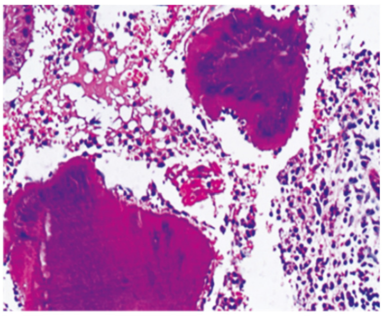
AIIMS 2019, 2021, 2022
FMGE 2018, 2019, 2022

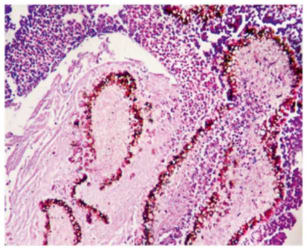
- Bacterial
  - Antibiotics-clotrimaxazole or amikacinx6-12 months
- Fungus
  - Antifungal drugs
  - Sinuses can be removed with Surgery
  - amputation(end treatment if everything fails)

Actinomycetoma	Feature	Eumycetoma
Gram positive bacteria	organism	fungus
Actinomadura madurae	examples	

• Red
  ○ actinomadura pelletieri
• Off white/yellow
  ○ Nocardia
  ○ Streptomyces
  ○ actinomadura
	granules	• Brown
		  ○ Madurella exophiata
		  ○ Produces melanin

- Looks filamenticious
- Rays of sun appearance
- Pink layer around it Called splendre hoepplei phenomenon
  - Antigen -antibody reaction getting deposited





RHINOSPORIDIOSIS

00:23:30

- Organism -rhinosporidum seeberi
- Strawberry like polyps coming from nose
- Aquatic protozoa
- H/o swimming usually present

Microscopy

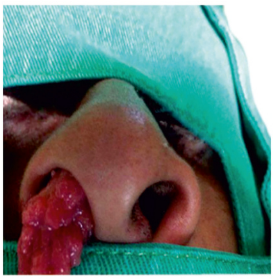
- Sporangia with endospores

Culture Media

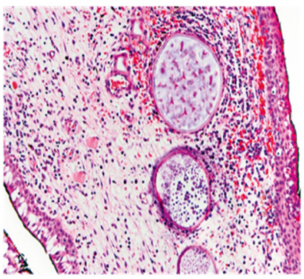
- Non cultivable organism

Treatment

- Polypectomy



Strawberry Nasal Polyp



Endospores appear inside sporangia

CHROMOBLASTOMYCOSIS

00:25:28

Organism

- Caused by
  - Fonsecea pedrosi
  - Fonsecea compacta
  - Exophiala
  - Phialophora
  - Cladophialophora

Route

- h/o bare foot walking followed by trauma

Clinical Features

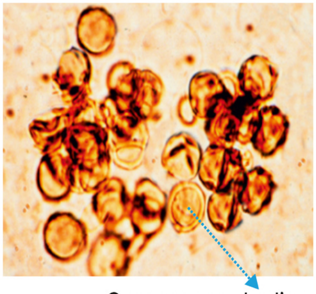
- Cauliflower like lesions seen
- warts/verrucous dermatitis

Microscopy

NEET PG 2022

- Copper penny body a/k/a
  - Medlar bodies
  - Muriform bodies
  - Sclerotic bodies

Verrucous Dermatitis



Copper penny bodies

Treatment

- Amphoterecin B
- Sx-wide local excision
- Laser can be done for cosmetic reason

DIMORPHIC FUNGI

00:27:45

- Yeast -37degree
- mold/hyphae-22-25 degree

Mnemonic-Body Heat Probably Changes Shape

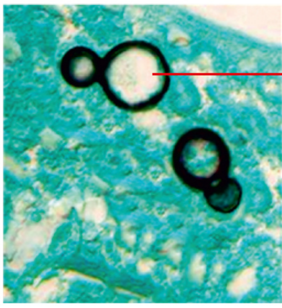
Dimorphic	Fungus	Images
blastomyces	NA blastomycosis/gilchrist/chicago disease	Figure of 8
histoplasmosis	Ohio disease/cave disease/darling disease	Yeast Tuberculate macroconidia bird/bat droppings
Penicillium marneffi	Talaromyces marneffi	Bamboo rats-reservoir Red pigment Broom appearance
paracoccidiomycosis	SA blastomycosis	Mickey mouse Pilot wheel appearance
coccidiomycosis	Dessert rheumatism/valley fever	Barrel arthrospores
Sporothrix schenkii	Rose garder's disease	Lymphocutaneous Cigar body, Asteroid body Rosettes of conidia

Blastomyces

NEET PG 2022

- a/k/a north american blastomycosis/chicago disease/gilchrist disease

- Looks like figure of 8
- Shows broad based budding



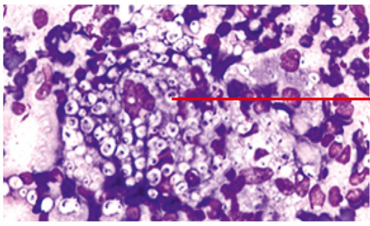
AIIMS 2019, 2021

Histoplasmosis

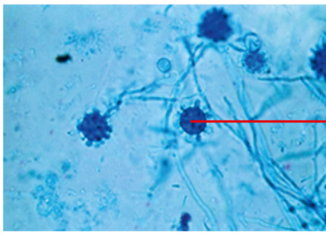
- A/K/A ohio disease/darling disease/cave's disease/reticuloendotheliosis
- Reservoir-bird and bat dropping

Microscopy

- Yeast forms within macrophages seen
- Tuberculate macroconidia seen



Yeast form



LPCB stain on SDA agar

Penicillium Marneffei

Neet PG 2024

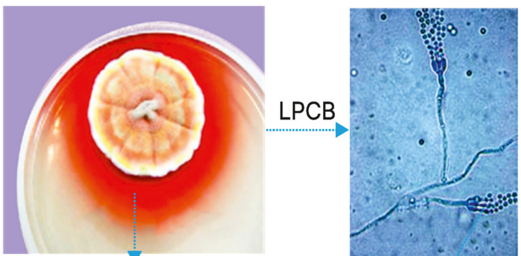
- A/K/A talaromyces marneffei
- Natural reservoir-bamboo rats

Microscopy

- broom/brush appearance on lactophenol cotton blue test

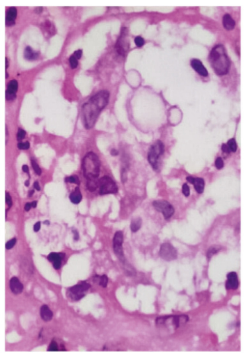
Culture

- Red pigment on SDA

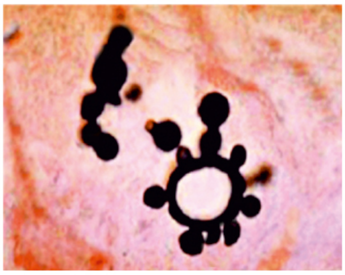


Paracoccidioidomycosis

- Classical mickey mouse appearance



- Pilot wheel appearance

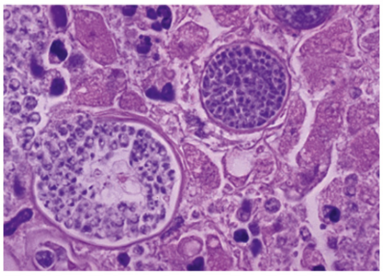


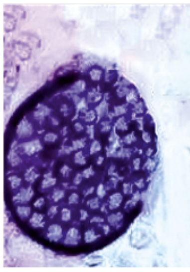
Coccidioidomycosis

- A/K/A desert rheumatism/valley fever/california disease
- Joints are involved

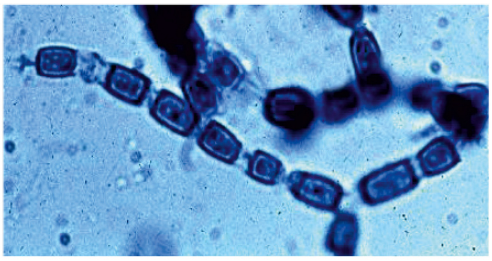
Microsscopy

- Cup shaped spores





- Barrel shaped arthrospores



Sporothriz Schenkii

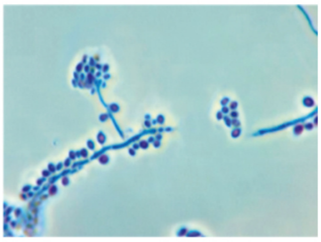
AIIMS 2019, 2021
Neet PG 2024
FMGE 2024

- Both subcutaneous and dimorphic/rose gardeners disease
- Causes sporotrichosis

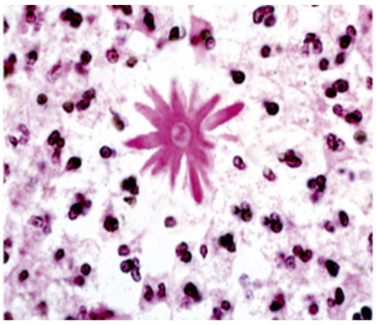
Route

- Traumatic thorn prick
- Lymphatic spread of the fungus-lymphocutaneous spread

Microscopy



- Rosettes of conidia seen
- Asteroid body seen
  - Splender hoepli phenomenon
- Centre has cigar body
  - Yeast form of the fungus



Opportunistic Infections
- Occurs in immunocompromised individuals

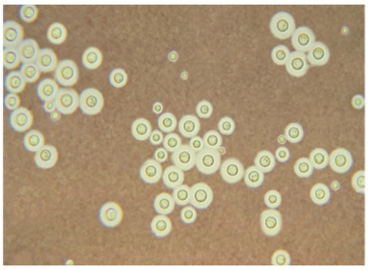
Cryptococcus

FMGE 2023, 2025
INICET 2024, 2025

- Causes meningitis
- Has 2 forms
  - C.gattii
  - C.neoformans

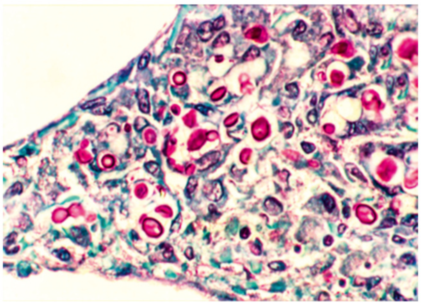
Cryptococcus neoformans	Features	Cryptococcus gattii
World	Distribution	Tropic/subtropical area
Soil with pigeon droppings	Isolation	Soil around eucalyptus tree
Immunocompromised	Immunity	Immunocompromised+immunoefficient people
Good response to antifungal	Treatment	Prolonged treatment

Microscopy

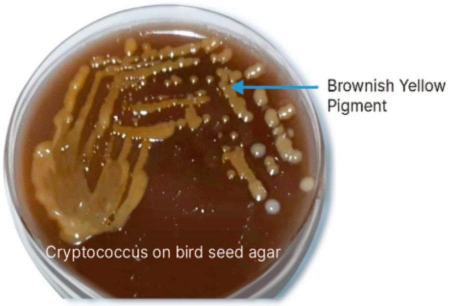


- On lumbar puncture add negative stain on CSF sample
  - Background gets coloured ,organism unstained

Biopsy
- Mucicarmin stain used



Culture



- Bird seed nigar agar is used
- Brown coloured culture media
  - Bcz of enzyme phenol oxidase/laccase

Investigations

- Look for antibody in CSF using ELISA ab CSF
- Lateral flow assay
- Latex agglutination test

Treatment

- Liposomal amphotericin B +flucytosine (initial treatment)
- fluconazole(following treatment)

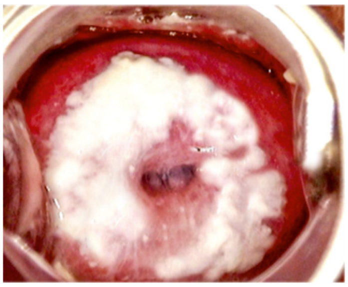
Candida

- Includes
  - Candida albicans
  - Candida dubliniensis
  - C.glabrata-no pseudohyphae
  - C.auris-resistant to azoles
  - C.krusei-resistant to azoles
  - C.kefyr-used control in susceptibility test

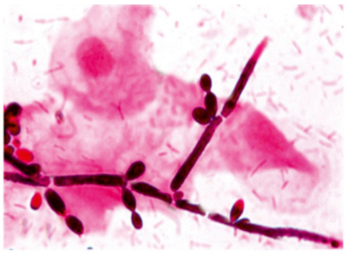
NEET PG 2019
FMGE 2020, 2025

Features

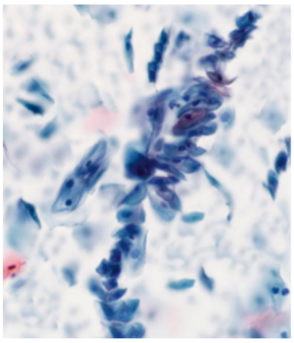
- Curdy white discharge



- PAP smear -sheesh kabab seen

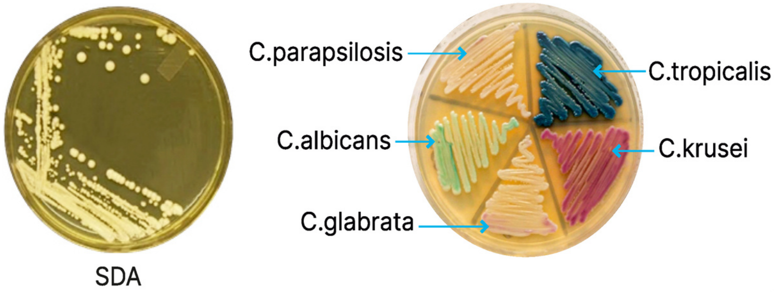


- Buds and pseudohyphae seen

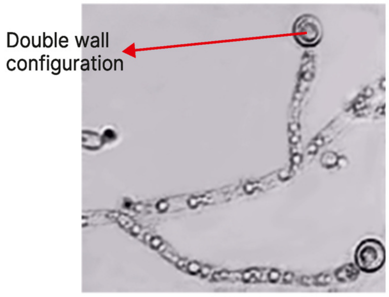


Yourwish

- Culture -SDA
    - Creamy pasty yeasty colony
    - Chrom agar is used to differentiate various candida varieties

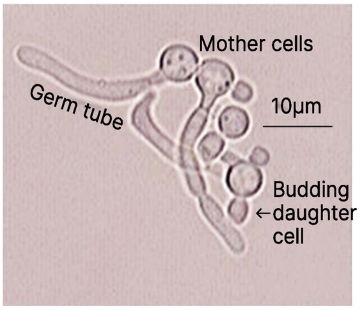


- Corn meal agar
    - → Chlamydospore seen



Chlamydospores

- Germ tube test
    - Reynold braude phenomenon is seen

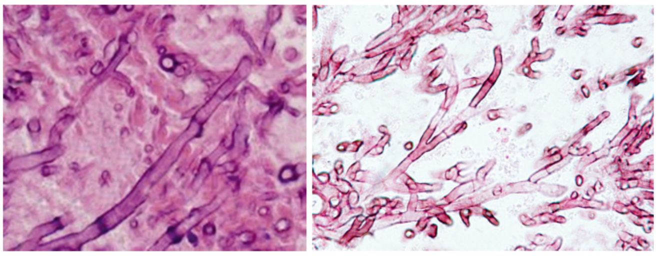


Important Information

- Candida albicans Growth >45 degree hypertonic saline

Aspergillus

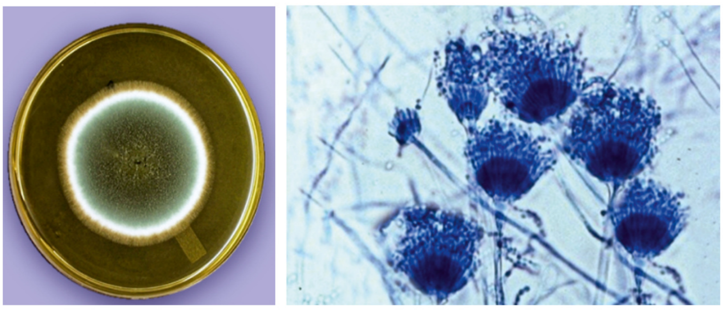
- Septate hyphae
- Acute angle dichotomous branching (45 degree)
- Hyphae septate



Types

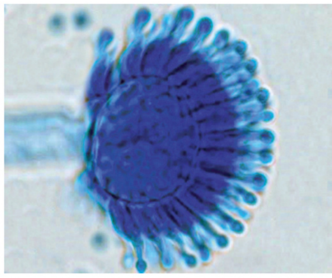
Aspergillus Fumigatus

- Smoky green
- Conidia along upper part of vesicle



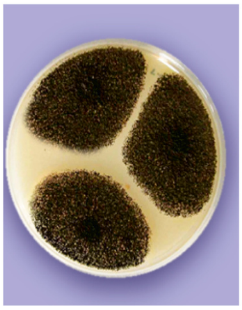
Aspergillus Flavus

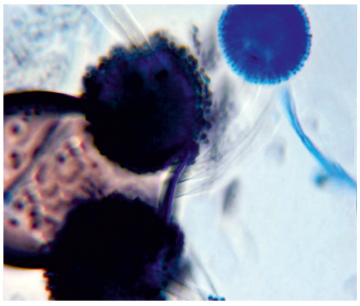
- Yellow green
- Conidia all around vesicles
- Looks like a flower
- Toxin produced aflatoxin
  - Causes mutation at P53 gene at codon 249→liver cancer



Aspergillus Niger

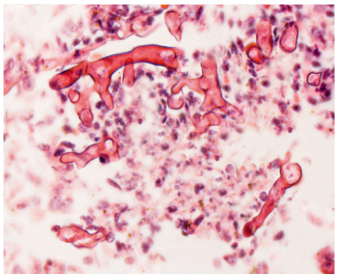
- Black coloured culture media obtained

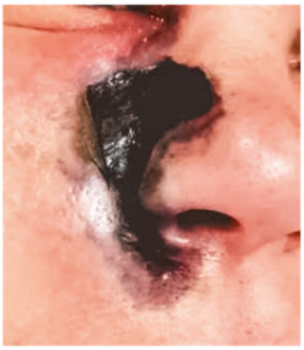




Zygomycetes - Mucor

- Obtuse angle branching
- Aseptate hyphae present
- Broader hyphae/ribbon like hyphae
- Produces black lesions





Culture

- Cotton like growth
- Lid lifter is other name

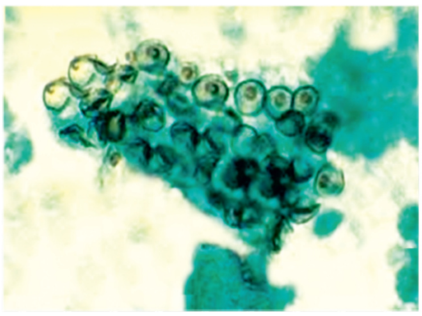
Pneumocystits Carnii/Jeroveci

FMGE 2023
AIIMS 2021
Neet PG 2025
INICET 2025

- Not have ergosterol in cell membrane
- Has cysts and trophozoites in life cycle
- Seen in HIVCD4<200

Clinical Features

- Causes pneumonia
  - Not have sputum
  - Dry cough present
  - Bronchoalceolar lavage sample taken
    - → Many plasma cells
    - → Crushed ping pong ball appearance



Treatment

- DOC→clotrimaxazole
- Severe cases-pentamidine

TESTS FOR FUNGI

00:56:41

Beta -(1,3)d-glucan	Aspergillus galactomannan
Diagnosis of all fungal organism except • Blastomyces • Mucormycosis • cryptococcus	Diagnosis of invasive aspergillosis

Treatment Summary For Various Fungi

Organism	Treatment
Tinea vesicolor	Topical/systemic azole
dermatophytes	Azole/terbinafine (T.capitis=griseofulvin)
Blastomycosis Histoplasmosis Paracoccidio Sporothrix	Amphotericin B+Itraconazole
Coccidiidomycosis Candida Cryptococcus	Amphoterecin B +fluconazole
Cryptococcal meningitis	Liposomal amphoterecin B + Flucytosine followed by candida
Candida	Topical nystatin Clotrimazole
Fungal keratitis	Natamycin
Aspergillus	Voriconazole
Mucor	Amphoterecin B + Posaconazole/isavuconazole
Pneumocystitis	Cotrimoxazole Pentamidine

PYQs

01:00:22

Q. Which disease is commonly referred to as "Desert Rheumatism? NEET PG Aug 2024

a. Coccidomycosis

b. Histoplasmosis
c. Paracoccidioidomycosis
d. Mucormycosis

Ans: A

Q. Which organism is associated with broad-based budding? NEET PG Aug 2024
a. Sporothrix schenckii
b. Blastomyces
c. Talaromyces marneffel
d. Paracoccidioldomycasis

Ans: B

Q. A central line infection is noted in an ICU patient, and staining shows a gram-positive oval-shaped organism that reproduces by budding. Identify the organism:
a. Staphylococcus aureus
b. Candida
c. Staphylococcus epidermidis
d. Escherichia coli

Ans: B

Q. A patient presents with low-grade fever, chronic cough, and weight toss. Fungal culture from respiratory secretions shows the following organism with namrow-based budding on microscopy. What is the most likely diagnosis?
a. Blastomycosis
b. Histoplasmosis
c. Cryptococcosis
d. Coccidioidomycosis

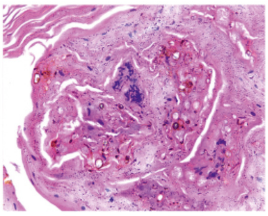
Ans: B

Q. A 24-year-old woman presents with hypopigmented macules and constituent patches over the chest. Skin scraping and KOhl preparation show an abundance of yeast-like cells and short branch filaments like a Spaghetti and meatball appearance' as shown in the Image below. What is the most likely organism?
a. Malassezia
b. Trichophyton
c. Chlamydospores
d. Candida

Ans: A

Q. What is the most probable diagnosis for a farmer who has a wart-like kind growth on his foot and histopathology of the growth is shown in the below Image? FMGE June 2022

a. Sporotrichosis
b. Mycetoma Cronny
c. Chronic phinosporidiasis



Ans: B

Q. Which of the following dimorphic fungi causes subcutaneous mycosis? FMGE Jan 2023
a. Sporothrix schenckii
b. Histoplasma capsulatum
c. Blastomyces dermatitidis
d. Penicilium marneffei

Ans: A

Yourwish

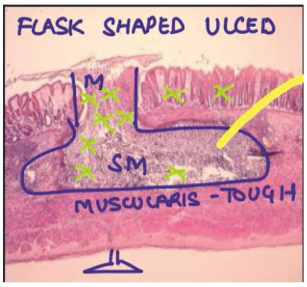
1. PARASITOLOGY PART 1

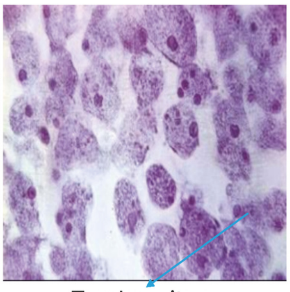
AMOEBA

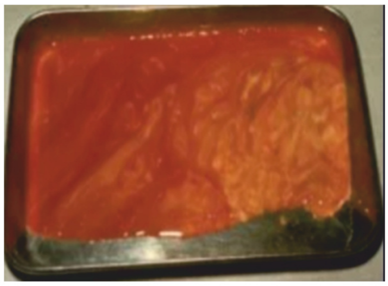
Entameba Histolytica

00:00:15

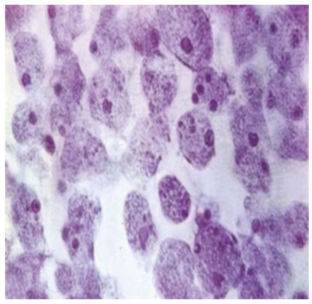
- Amoeba is the family
  - Histo- tissue
  - Lytica- breakdown
  - Enteric- git




Trophozoites

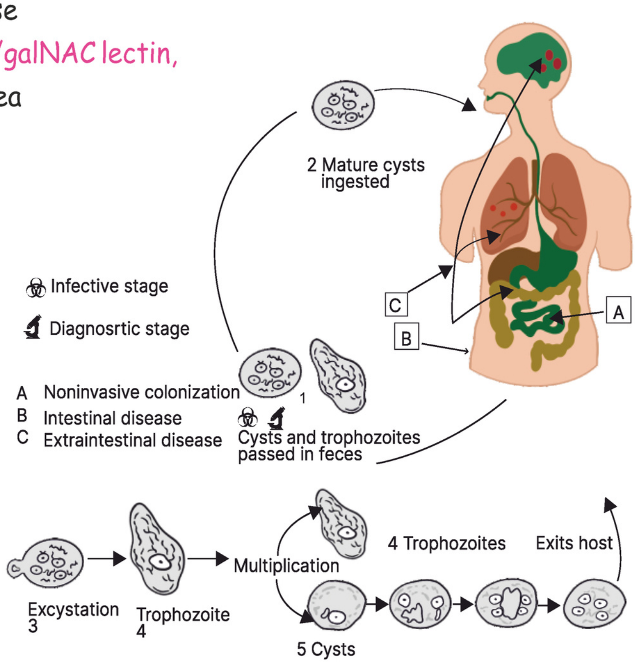

Anchovy sauce appearance

- Mucosa submucosa break: flask-shaped ulcer
- Liver broken down
  - Brown coloured pus: anchovy sauce pus
- Under microscope
  - Trophozoites are seen showing erythrophagocytosis



Lifecycle

- Host- humans
- Mode- fecooral
  - Infective form- quadrinucleated cyst
  - 10-20 cyst infectivity dose
- Binds to the GI tract via gal/galNAC lectin, interestingly causing diarrhea

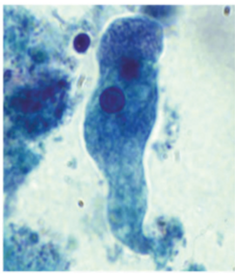


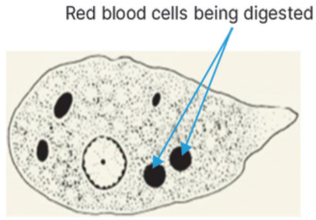
Diagnosis

- Stool sample collected
  - 3 consecutive-day stool sample taken
- The trophozoite/cyst form is seen
- Ecoli can also be seen

Trophozoite Cyst

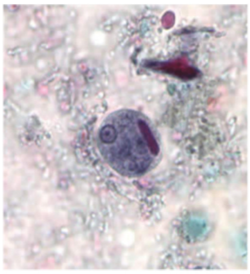
- Erythrophagocytosis
- One nucleus, central dot- cartwheel appearance

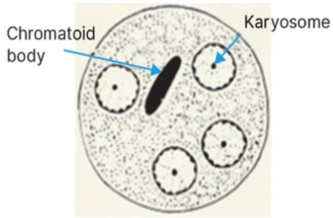




Cyst Form

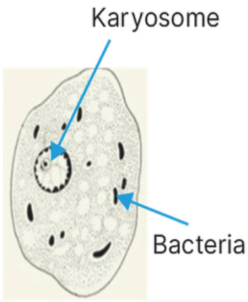
- 1-4 nuclei
- Thick body present/thick chromatoid body

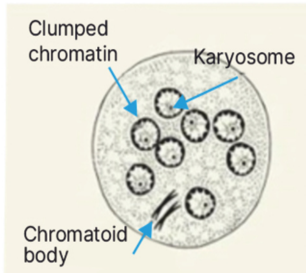




E.Coli

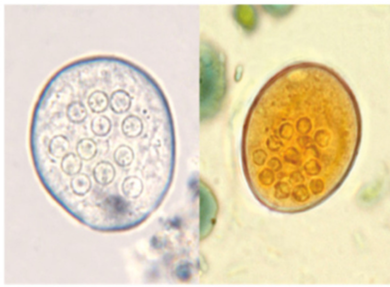
- Normally also present in the stool of healthy people
- Eccentric nuclei present
- One nucleus in a trophozoite form
- Cyst has 8nuclei
- Chromatoid bar is thin





Chromatoid Body

- Composition- Ribonucleic protein
- Spl stain- Iron hematoxylin stain used



Stool Culture

- Axenic culture media
  - Pure culture media
  - No supplement added
  - E.g., Diamond medium
- Polyxenic medium
  - Bacterial Supplements are added
  - E.g., Nelson culture, Balamuth medium, Boeck and Dr. Bohlav medium, Craige's culture

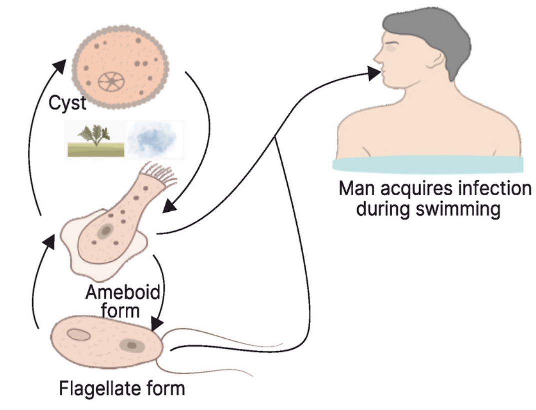
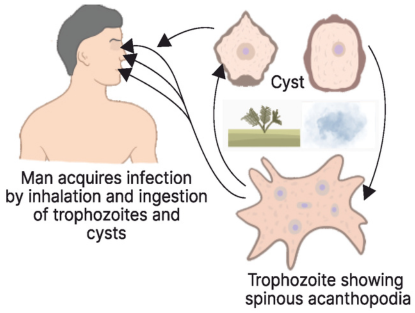
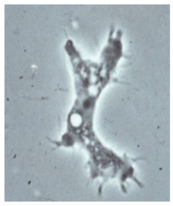
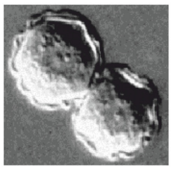
Treatment

- Metronidazole x 10 days (controls diarrhea)
- Followed by luminal amebicide- Paromomycin

Free Living Amoebia

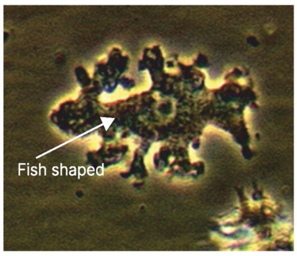
00:07:01

- Consists of 2 organisms
  - Naegleria fowleri
  - Acanthameba
- Both are brain-eating amoeba

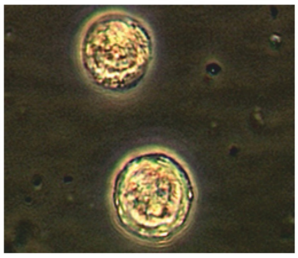
Naegleria fowleri	Features	Acanthameba
Primary amoebic meningoencephalitis	**Disease**	Granulomatous amebic encephalitis Contact lens keratitis
Swimming in dirty water	**Risk factor**	Immunodeficiency
Nasal→ cribriform plate→ neural	**Spread**	Nasal/oral/eyes/blood
Trophozoite	**Infective form**	Trophozoite and cyst
Acute- fatal	**Clinical course**	Chronic
	**Life cycle**	Trophozoites- Spikes Cysts- Wrinkled and double-walled   

Balamuthia Mandrillaris

- Causes Granulomatous amoebic encephalitis
- No eye involvement
- Immunocompetent and immunocompromised individuals
- Trophozoite form- Fish-shaped
- Cyst form- Smooth-walled



Trophozoite

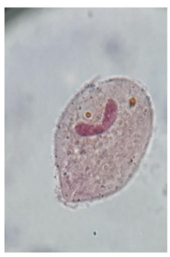

Cyst

Diagnosis

- **Culture-** NNA (non-nutrient agar) with E coli
- **GOLD STD-** NAAT (nucleic acid amplification testing)

Balantidium Coli

- Only ciliated protozoa go to the intestine
- Largest protozoan
- Causes diarrhea infests large intestine
- Trophozoite and Cyst forms are binucleated
  - Bigger nuclei is bean shaped
- **Treatment**
- Doxycycline

Yourwish

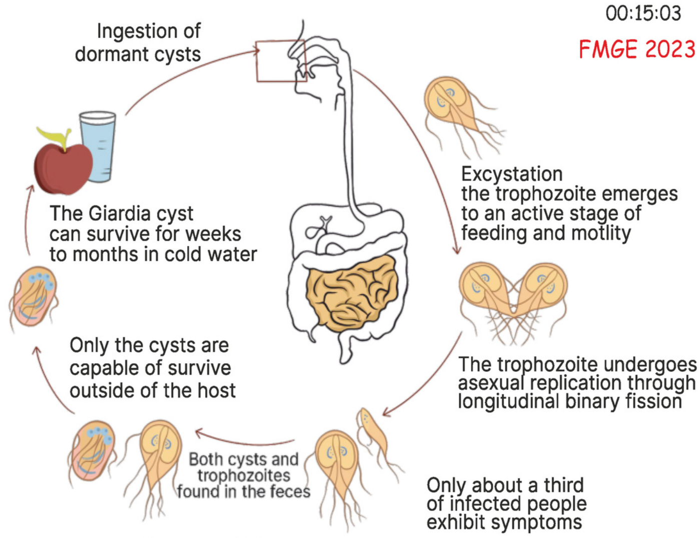
FLAGELLATES

00:15:03

FMGE 2023

Giardia Lamblia

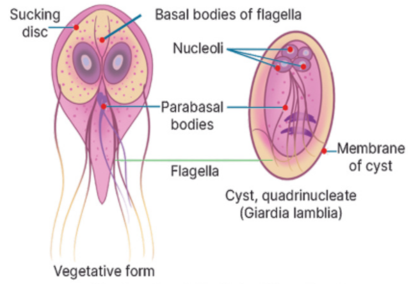
- MC parasitic infection in the world
- MC parasite found in the stool
- Route of infection- Faecooral route
- Small infectivity dose
- Cyst form is infectious
  - Habitat- duodenum
  - Location- luminal



Life cycle of Giardia lamblia

Clinical Features

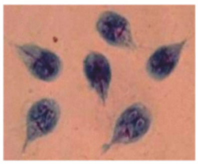
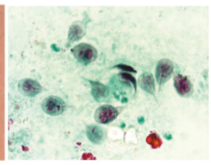
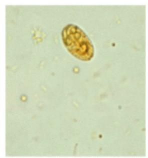
- Malabsorption
  - Steatorrhea
  - Megaloblastic anemia



Trophozoite of Giardia lamblia and cyst

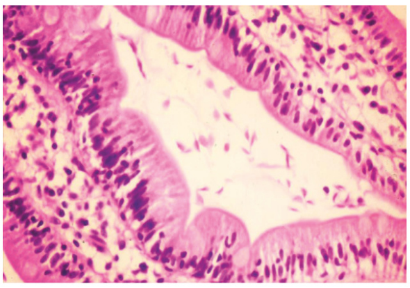
Diagnosis

- 3 consecutive-day stool sample
- Trophozoite
  - Pear-shaped/tennis racket
  - 2 nuclei
  - 4 pairs of flagella
  - Sucking disc
  - Falling leaf motility

- Cyst
  - Nuclei present- 4
- String test/enterotest
  - A capsule attached to a string is ingested by the patient, and the string is pulled out to catch the organism from the duodenum

- Biopsy
  - Luminal sickle shape



Treatment

- Metronidazole
- Tinidazole (2g once)

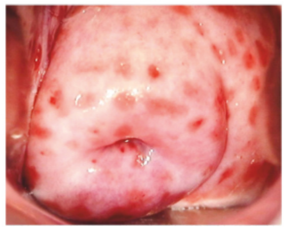
Trichomonas Vaginalis

NEETPG 2023
FMGE 2022

- MC cause Sexually transmitted diseases and non-gonococcal urethritis
- Mode of transmission is sexual
- Habitat- Urethra, vagina, prostate
- Reservoirs are female

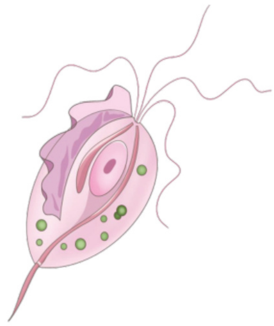
Yourwish

Clinical Features



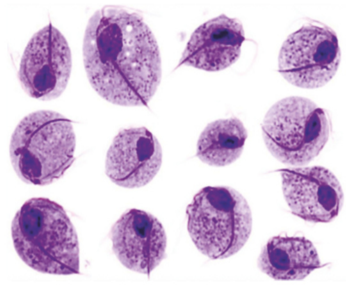
- Female-
  - Strawberry cervix
  - Angry-looking cervix
  - Discharge is greenish in colour
- Male
  - Urethritis, prostatitis

Microscopy



- Infective and Diagnostic stage- Trophozoite form
- No cyst form exists
- Trophozoite form
  - 1 nucleus
  - 5 flagella total (4 anterior, 1 posteriorly)
- Motility twitching/jerking motility

Culture



- Lash cysteine hydrolysate serum
- Diamond medium

Treatment

- Metronidazole- DOC
- Partner treatment required

Organism	Trophozoite	Cyst
E.histolytica	1	1-4
E.coli	1	1-8
B.coli	2	2
Giardia	2	4
Trichomonas	1	Not existing

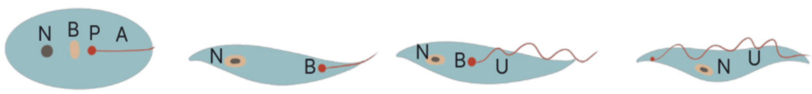
HEMOFLAGELLETES

00:26:09

- Consists of
  - Trypanosoma cruzei
  - Trypanosoma brucei
  - Leishmania

Microscopy

- All exist in four forms
- Amastigote
  - Nuclei present



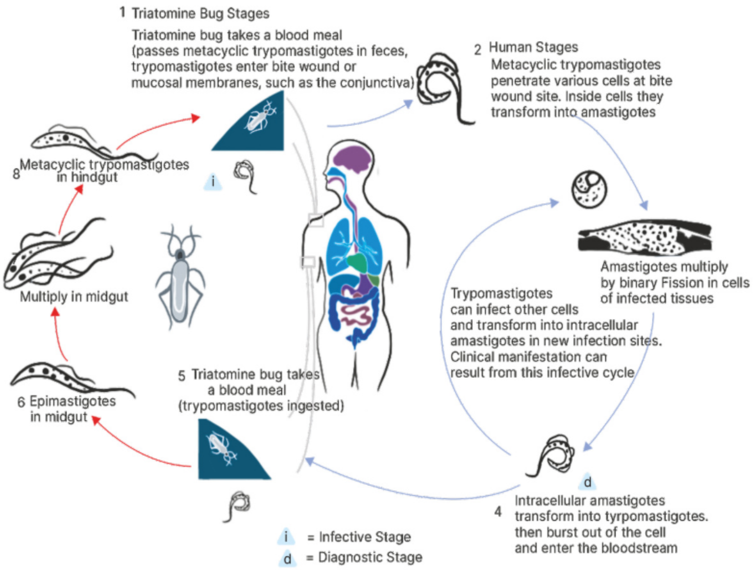
  - No flagella
  - Nucleus present
  - Kinetoblast (parabasal body + blepharoplast)
  - Nucleus posterior kinetoblast anteriorly
- Promastigote
  - Nucleus posterior kinetoblast anteriorly
  - Nuclei present
- Epimastigote
  - Nucleus posterior kinetoblast anteriorly
  - Nuclei present
  - Found in insects
- Trypomastigote
  - Kinetoblast displaced behind the nucleus
  - Nuclei present
- T.brucei- Epimastigote, Trypomastigote
- T.cruzi- Amastigote, Trypomastigote, Epimastigote
- Leishmania- Amastigote, Promastigote
  (BET CATE LAP)-mnemonic

Organism	Disease	Vector
T.cruzi	Chagas disease	Reduviid bug/triatomine bug (nocturnal)
Trypanosoma brucei	Sleeping sickness	Tse tse fly
Leishmania	Kalaazar	Sandfly

Lifecycle T.Cruzi

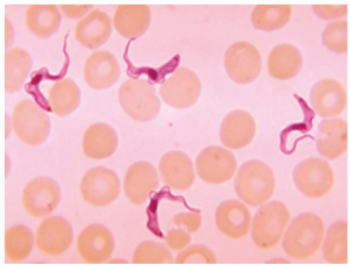
FMGE 2019

- Occurs in humans and insects
  - Humans- Amastigote, Trypomastigote
  - Insect- Trypomastigote, Epimastigote
- Causes Chagas disease/South American sleeping sickness
- Caused by the kissing bug/reduviid bug



Acute chagas disease	feature	Chronic Chagas disease
• Peri-orbital swelling • Romana sign 	**Site**	• Cardiomegaly • Megaesophagus (Achalsia cardia) • Megacolon

Sample



- Blood
  - Trypomastigote form seen (post-nuclear kinetoplast seen)
  - NNN culture media used

Treatment

- DOC -benznidazole

Important Information

Parasites causing myocarditis

- Trichinella spiralis
- T.cruzi
- TB rhodesiense
- Toxoplasma gondii
- Echinococcus

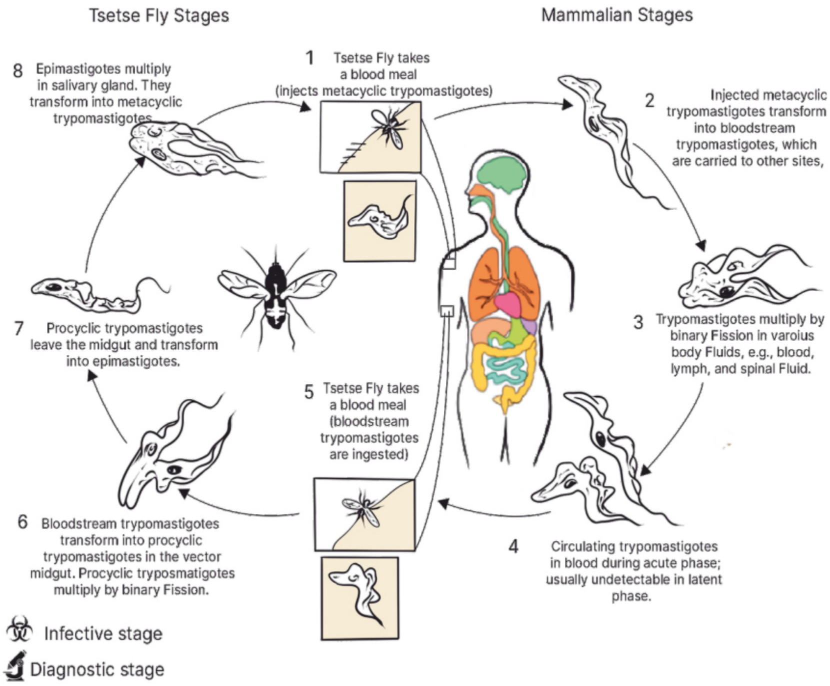
(mnemonic- myocardittttes)

Lifecycle T.Brucei

- Causes African sleeping sickness
- Tse tse fly vector
- Lifecycle
  - Human- Trypomastigote
  - Insect- Epimastigote, Trypomastigote
- 2 types
  - T.B Gambiense
  - T.B rhodesiense

African Trypanosomiasis

Trypanosoma brucei gambiense & Trypanosoma brucei rhodesiense



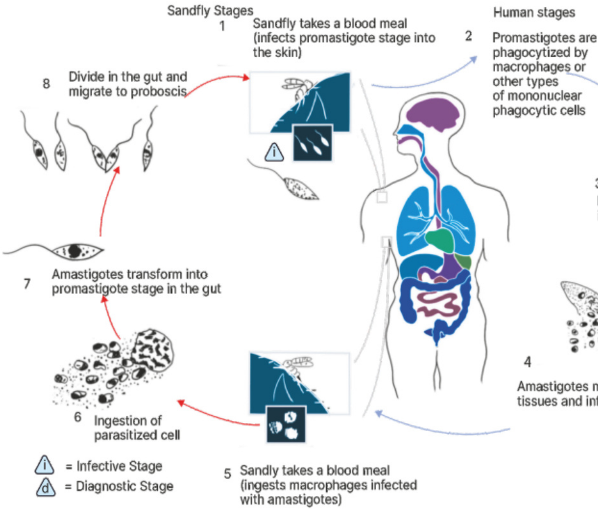
Yourwish

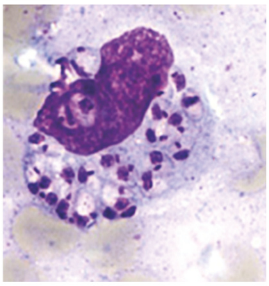
T.b gambiense	Feature	T.b rhodesiense
West African sleeping sickness	**Aka**	East African sleeping sickness
Tse tse fly	**Vector**	Tse tse fly
Humans	**Primary Reservoir**	Humans and animals
Winter bottom sign	**Clinical Features**	
	Parasitemia **Virulence** **Resistance**	• More • More • Early resistance to drugs
Pentamidine	**Treatment**	• Early- Suramine • Late- Melarsoprol

Leishmania Donovani

- Sandfly
- Infective form promastigote
- Microscope- Amastigote seen as L. donovan bodies
  - Bigger dot- Nucleus
  - Small dot- Kinetoblast
  - Seen inside a macrophage
- Disease- Kalazar
- Clinical features
  - Pigment of skin hyperpigmentation
  - HSM (Massive splenomegaly)

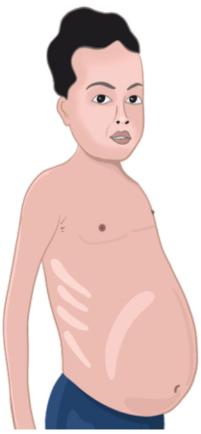
NEET PG 2018
AIIMS 2020





Sample

- Spleen (most sensitive)
- Bone marrow (most preferred)
- Blood
- HIV individuals BAL taken



Media

- NNN form grows promastigote

Investigations

- Hypergammaglobulinemia
  - Napier's aldehyde test
  - Chopra's antimony test

- Rapid card test- RK39 Ag
- PCR

Treatment
- Liposomal amphotericin B

Post Kalazar Dermal Leishmaniasis
- Hypopigmented lesions seen
- 1-2 years after treatment

Treatment
- Oral miltefosine

Others
- L. tropica- Oriental sore/Delhi boil/Aleppo button
- L. brasiliensis- Espundi (mucocutaneous leishmaniasis)

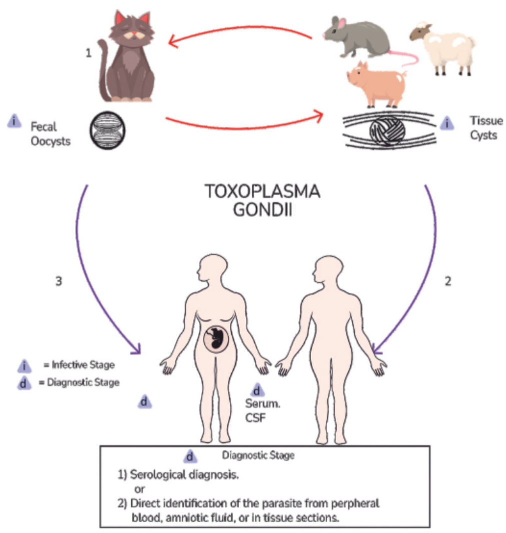
Leishmaniasis Recidivans
- Often due to inadequate treatment
- Nodular lesions or rash around the central healing

COCCIDIAN PARASITES

INICET 2021, 2023, 2025
NEET PG 2018

00:46:40

Toxoplasma Gondii
- Definitive host- Cat
- Intermediate host- Humans, other animals
- Mode of transmission
  - Sporulated oocyst: Contaminated soil/food/water
  - Bradyzoite: Undercooked meat
  - Tachyzoite: Blood transfusion



Clinical Features

Congenital toxoplasmosis	• More severe if in the 1st trimester • More risk of transmission in the 3rd trimester ○ Chorioretinitis ○ Cerebral calcification ○ Convulsions ○ microcephaly/hydrocephalus ○ Mental retardation
Adult toxoplasmosis	• Asymptomatic • Lymph nodes enlarge
Hiv + toxoplasmosis	• Encephalitis • MC brainstem

Important Information

- Calcification in the brain
    - Cerebral calcification- Toxoplasma
    - Periventricular calcification- CMV
    - GM-WM junction calcification- Zika virus

Diagnosis

- Sabin-Feldman test
- Checks for antibodies
- Methylene blue stain is used
    - If colour present- Antibodies not formed'
    - Color formed- Antibodies formed

Antibodies	Interpetation
IgM + IgG-	Acute infection
IgM + IgG + low avidity	Acute infection
IgG + strong avidity	Chronic infection

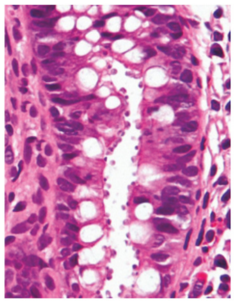
Treatment

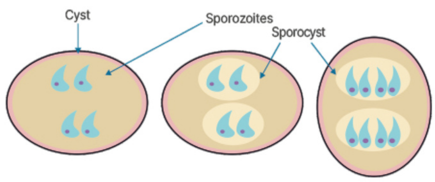
- Pyrimethamine + Sulfadiazine

Diarrhoea In Immunocompromised Host

00:54:07

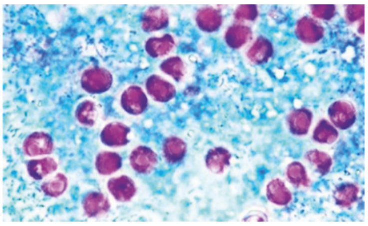
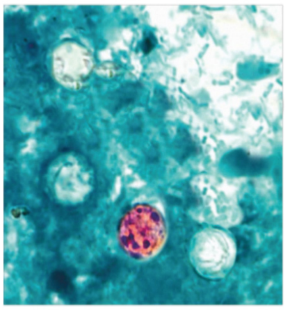
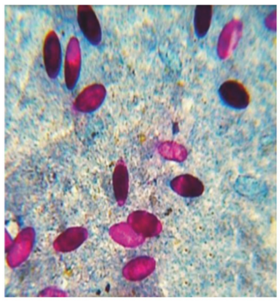
- Usually shows infection in HIV positive individuals
- Cryptosporidium
    - 4 sporozoites
    - Along the brush border- Parasitophorous vacuole
- Cyclospora
    - 4 sporozoites in 2 cysts
    - Raspberry consumption
- Isospora/cystospora
    - 8 sporozoites in 2 cyts





AIIMS 2022

Feature	Cryptosporidium	Cyclospora	Cysto-Isospora
Size	4-6 microns	8-12 microns	24-36 microns
Shape	Round shaped	Round shaped	Oval shaped
Acid Fast	+	±cyclical	+
Auto-fluoroscence	-	+	+
Treatment	Nitazoxanide	Cotrimoxazole	Cotrimoxazole

- Stain used- Cold ZN/Kinyoun stain/Gabbett stain

HEMATOZOA

01:00:12

Malaria

- Plasmodium vivax
- Plasmodium falciparum
- Plasmodium ovale
- Plasmodium malaroae

Clinical Features

Benign Malaria

- Cold phase- Chills
- Fever- Hot phase
- Sweating phase

Malignant Malaria

- Brain involved
  - P. falciparum
  - Causes a duct granuloma

Blackwater Fever

- Hemolysis takes place

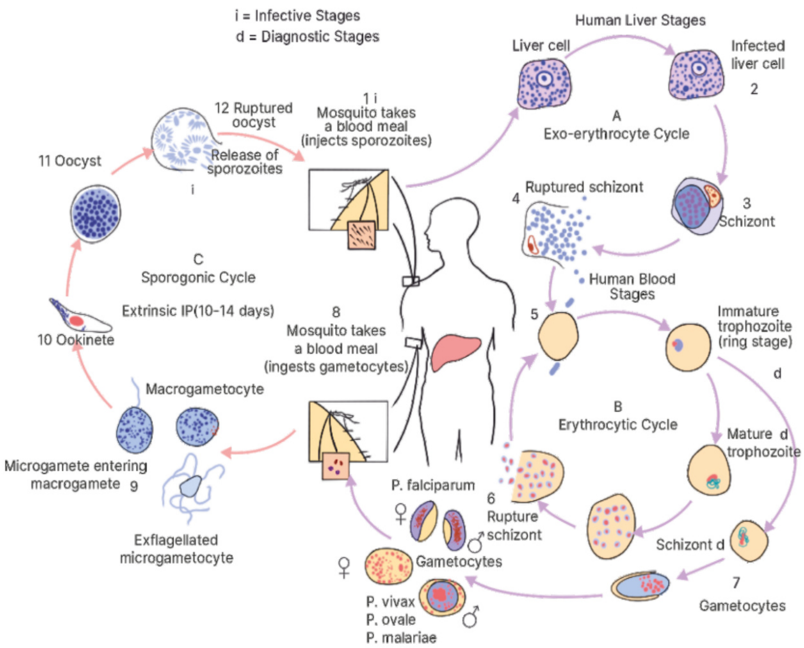
Algid Malaria

- Circulatory failure occurs

- **P.knowlesi**
  - Seen in monkeys
  - Found in Malaysia

Lifecycle

- Definitive host- Female anopheles mosquito
  - Extrinsic cycle
  - Incubation period- 10-14 days
- Intermediate host- Man
- Infective form to man



Yourwish

- Sporozoites from the saliva of mosquitoes
- Trophozoites from blood and mother-child transmission

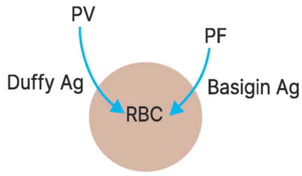
- No relapse in malaria with blood transfusion
- Infective form to mosquito- Gametocytes
- At least 12 gametocytes/microlite blood meal should be present to continue the sexual cycle

Feature	P. Vivax	P. Falciparum	P. Malariae	P. Ovale
Relapse	yes	-	-	yes
Recrudescence	-	yes	yes	-

Immunity A/G Malaria

AIIMS 2019
INICET 2024

- Sickle cell trait
- Thal trait
- Fetal Hb
- G6PD deficiency
- Ovalocytosis
- Duffy negative RBC
  - P. vivax enters RBCs through the Duffy antigen
  - P. falciparum enters through the Basigin antigen

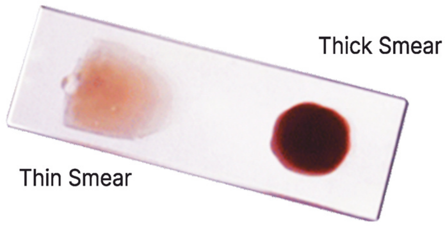


Lab Disagnosis

Microscopy

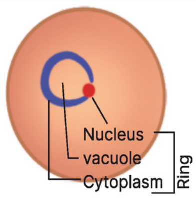
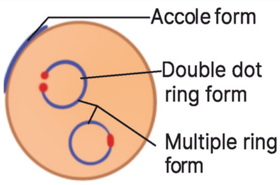
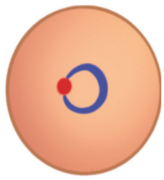
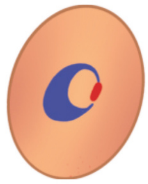
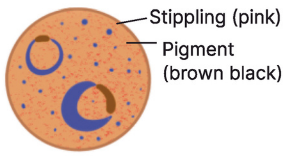
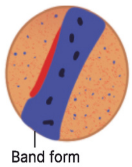
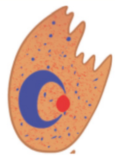
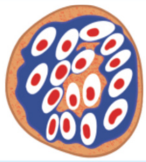
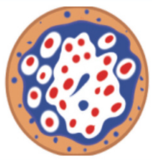
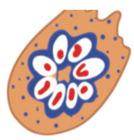
FMGE 2020, 2021
NEET PG 2020

- Light microscopy- Gold standard
  - Thick smear- Quantification
    → Sensitivity- 5 parasites/microlite
  - Thin smear to species identification
    → Sensitivity-200 parasites/microlitre

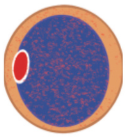
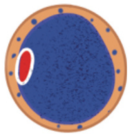
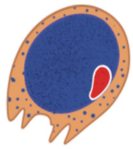
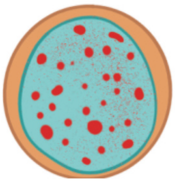
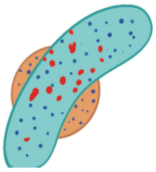
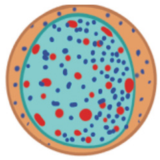
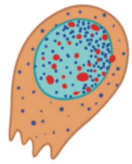


Stain

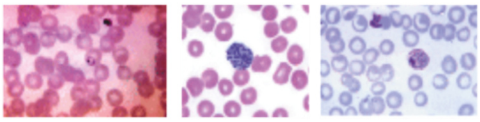
- Jaswant Singh Bhattacharya stain
- At least 200-3000 OIF examined before reporting no malaria

Plasmodium	P.vivax	P.falciparum	P. malariae	P. ovale
Early trophozoite				
Late trophozoite				
Schizont				

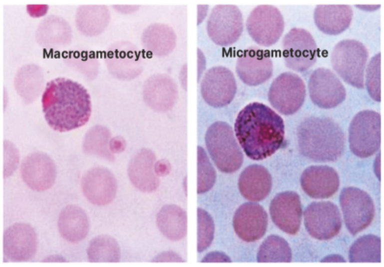
Yourwish

Female gametocyte				
Male gametocyte				

Trophozoite
- Ring form
- One ring, one dot



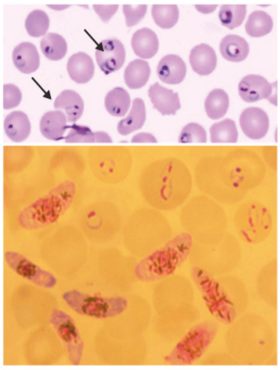
Schzont
- Merozoites



Gametocyte
- Oval shaped
- Macrogametocyte- Male
- Microgametocyte- Female

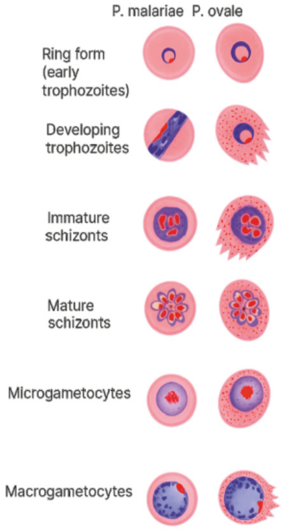
P. Falciparum

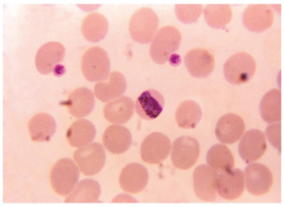
Trophozoite Form
- Many rings, many dots
- Accole/applique forms
- Rings present at the margin of the cell



Schizonts
- Never seen in blood
- Present in the brain blood vessels
  - Gets attached to ICAM

Gametocytes
- Banana-shaped/crescent-shaped
- Male- Chromatin dispersed
- Female- Chromatin well organised





P. Malariae
- Trophozite- Malaband form
- Malaria in blood form, hemazoin pigment

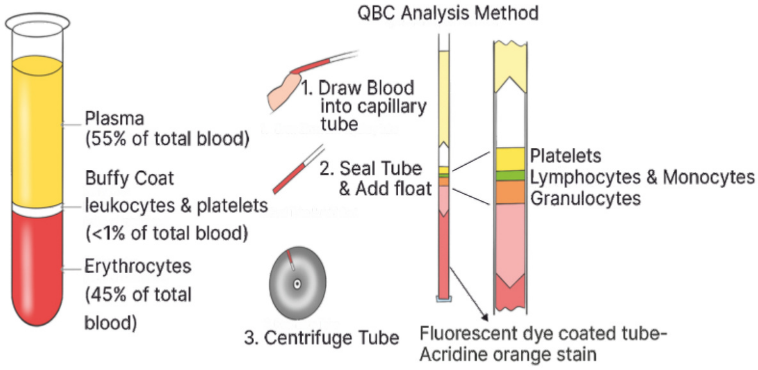
P.vivax	P.falciparum	P.malariae	P.ovale
Schuffner dot	Maurer clefts	Ziemann dots	James dots

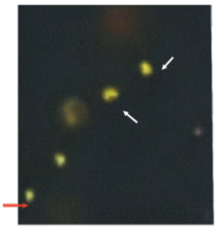
Fluoroscent Microscopy

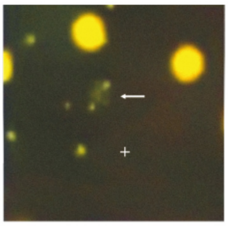
- Stain used acridine orange
- Kawamoto technique

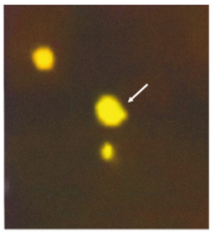
Quantitative Buffy Coat

- Buffy coat is examined
- The tube is lined with acridine orange
- Sensitivity is higher



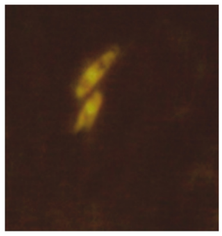

P.vivax- trophozoites


P.vivax- rings(+) and schizont (arrow)


P.vivax- gametocytes


Falciparum – Single ring

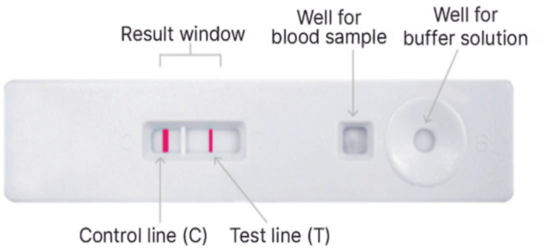

Falciparum – Double ring


Falciparum gametocytes

NEET PG 2023

Rapid Diagnostic Test

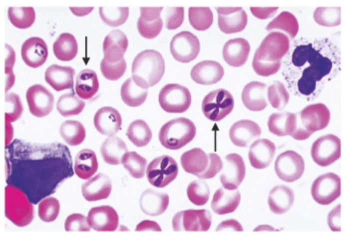
- The filter paper used is made of a nitrocellulose membrane
- Principle of card tests- Immunochromatography
- Principle of malaria card test- All malaria has 2 antigens
  - Aldolase
  - LDH1
  - P. falciparum has HRP2 also
- PCR
  - Most sensitive test



Basbesia Microti

Clinical Features

- Fever, malaise, chills, sweating
- Microscopy
  - Maltese cross
  - Tetrad of rings
- Definitive host- Tick
- Intermediate host- Rat



Treatment

- Azithromycin + atovaquone

PYQ

01:26:17

FMGE July 2023

Q. A 28-year-old female presents to the clinic with complaints of frequent diarrhea, abdominal cramps, bloating, and weight loss over the past two weeks. She mentions that she recently traveled to a rural area for a camping trip and drank untreated stream water during her stay. On physical examination, no fever is noted, but mild tenderness is present in the right upper quadrant of the abdomen. Stool examination reveals the presence of

trophozoites and cysts with characteristic "falling leaf" motility under microscopy. Which organism is most likely responsible for this patient's symptoms?
a. Salmonella typhi
b. Entamoeba histolytica
c. Giardia lamblia
d. Cryptosporidium parvum

Ans: **c. Giardia lamblia**

Q. Infection in humans occurs by ingestion of quadrinucleate cysts through contaminated food or water. Which of the following is likely the cause of this infection? FMGE Jan 2024
a. Giardia lamblia
b. Entamoeba Histolytica
c. Cryptosporidium
d. Cyclospora Cayetan

Ans: **b. Entamoeba Histolytica**

Q. Which of the following statements is true about Trichomonas vaginalis? NEET PG 2023
a. Trophozoite has 2 nuclei
b. Twitching motility is seen on a wet saline mount
c. Cysts are seen on wet saline mount of vaginal secretions
d. Infective form is a cyst

Ans: **b. Twitching motility is seen on a wet saline mount**

Q. A child presents with chorioretinitis, hydrocephalus, and cerebral calcifications.
What is the most likely causative organism?
a. CMV
b. Toxoplasmosis
c. Zika Virus
d. HIV

Ans: **b. Toxoplasmosis**

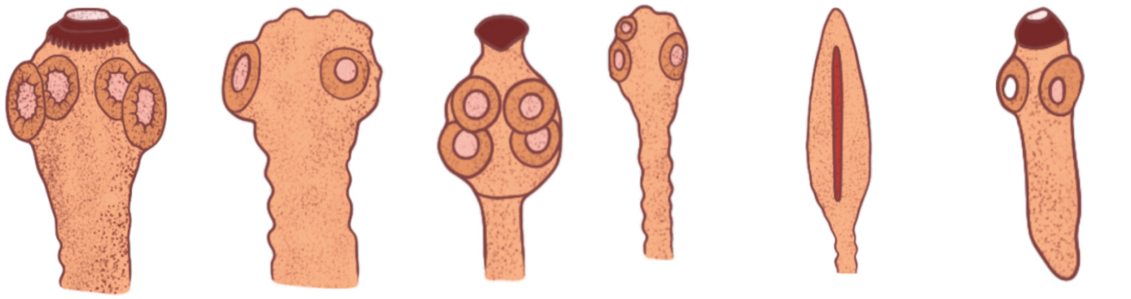
Yourwish

4. PARASITOLOGY – PART 2

CESTODES (TAPEWORMS)

00:00:10

FMGE 2020, 2025



T. Solium | T. Saginata | H. Nana | H. Dimunata | Diphyllobothrium Latum | E. Chinococcus

General Morphology

Adult Worms

Suckers	• All adult cestodes have **suckers on the head (scolex)** for attachment.
	• Exception → **Diphyllobothrium latum**
	  ○ **Di** = two; **Bothria** = grooves
	  ○ Two longitudinal grooves instead of suckers
	  ○ Head appears leaf-like

Hooklets	• Most cestodes have hooklets on the scolex.
	• Exceptions **(Mnemonic: TATA)**
	  ○ Taenia saginata
	  ○ Hymenolepis diminuta
	  ○ Diphyllobothrium latum
	• Usually **two rows** exception → **Hymenolepis nana** only **one row**

Eggs Of Cestodes

Hexacanth Embryo	• Contains 6 hooklets • Seen in all cestode eggs • Polar knobs → Present at both poles • Yolk granules → Granular material surrounding the embryo • Seen in H. nana, T. solium, T. saginata 

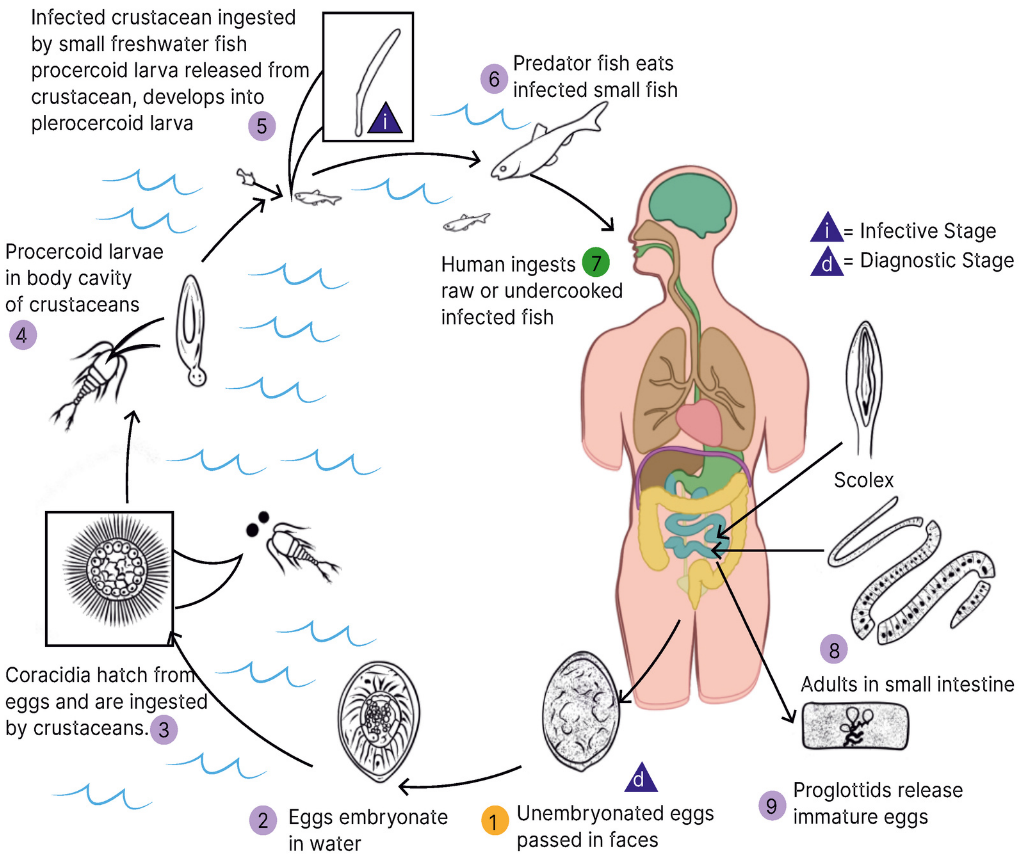
Hymenolepis diminuta	• Hexacanth embryo present • Polar knobs absent • Yolk granules absent	
Diphyllobothrium latum	• Operculated egg (lid present)	NEET PG 2024, FMGE 2019 

Important Information

- **Operculated Eggs Seen In**
  - Spirometra
  - Trematodes
  - Diphyllobothrium latum

Cestodes	Definitive host	Intermediate host	Extra
H NANA	Humans only	No intermediate host	• Dwarf tapeworm • Smallest tapeworm • MC cestode infection • Single row of hooklets
H DIMINUTA	Rat	Beetle	• Rat tapeworm
D LATUM	Human	Cyclops (small fish) Fish	• Fish tapeworm • Human → Cyclops → Fish → Human • **Infective Form for Humans:** L3 larva - Plerocercoid larva • Megaloblastic anemia • Due to Vitamin B12 deficiency
TAENIA SOLIUM	Human	Pig	• **Major Disease:** Neurocysticercosis • **Brain Involvement:** Brain parenchyma • **Radiology:** Starry sky appearance • **Symptoms:** Seizures
TAENIA SAGINATA	Human	Cattle	
ECHINOCOCCUS GRANULOSUS	Dog	Sheep Accidental dead-end host: Human	• Dog tapeworm • Water lily sign- Represents floating membranes inside cyst fluid. • ARC-5 Immunoelectrophoresis

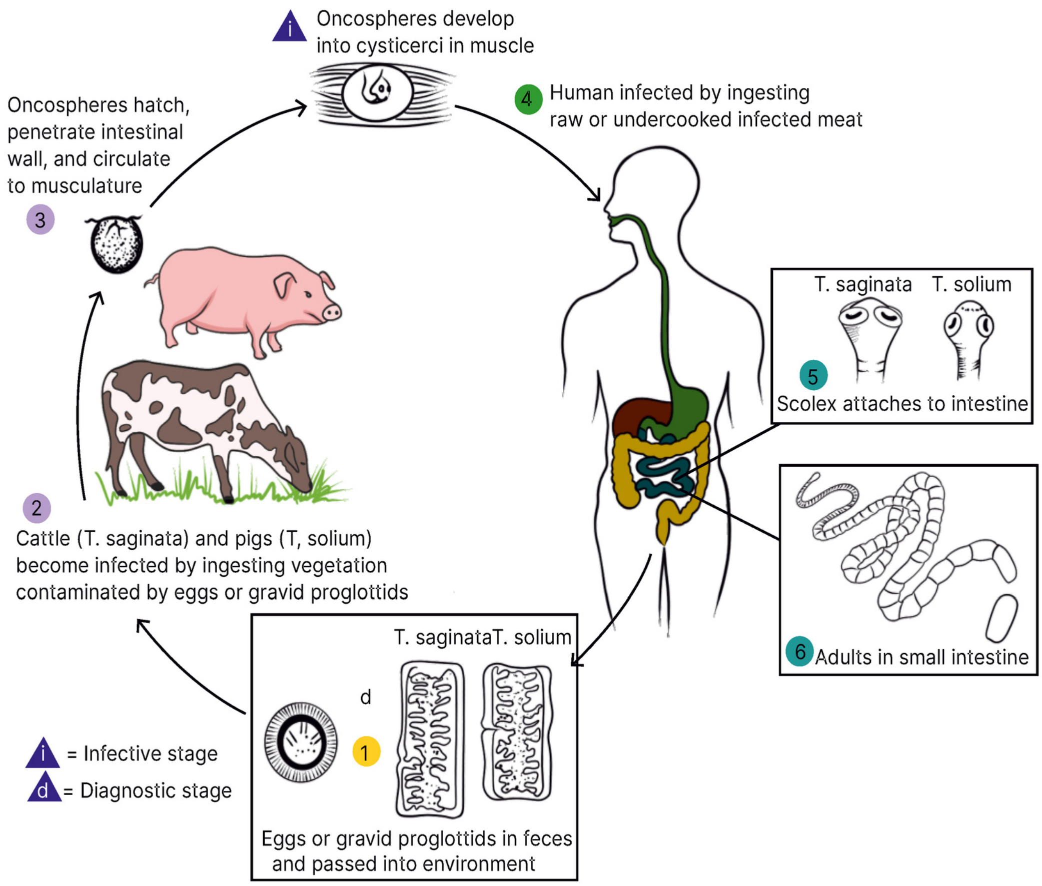
Life Cycle D. Latum



Taenia Saginata Vs Taenia Solium

FMGE 2019

Life Cycle



Feature	Taenia saginata	Taenia solium
Hooklets	Absent	Present
Length of worm	5-10 meters Longer	2-3 meters Shorter
Neck length	Longer	Shorter
Number of proglottids	1000-2000 More	Below 1000 Less
Gravid segment size	20 mm x 5 mm Larger	12 mm x 6 mm Smaller
Uterine branches	Lateral branched 15-30 on each side, thin and dichotomous	Lateral branches 5 - 10 on each side; thick and dendritic
Vagina	Present	Absent
Testicular follicles	300-400 follicles	150-200 follicles

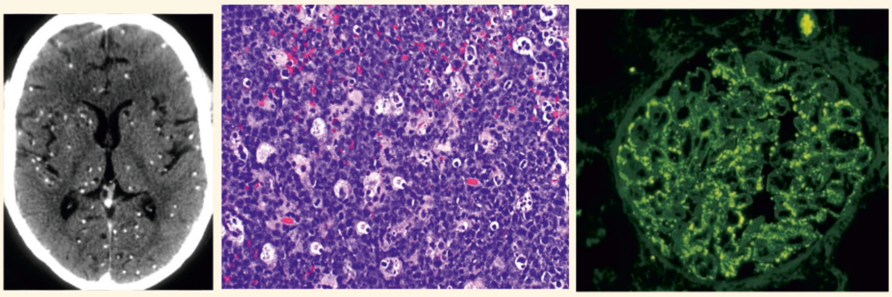
Larval Forms

Organism	Larval Form	EGG	Infection
Taenia saginata	Cysticercus bovis; present in the cow, not in man	Not infective to man	Intestinal
Taenia solium	Cysticercus cellulosae; present in pigs and also in man	Infective to man	Intestinal Cysticercosis

Important Information

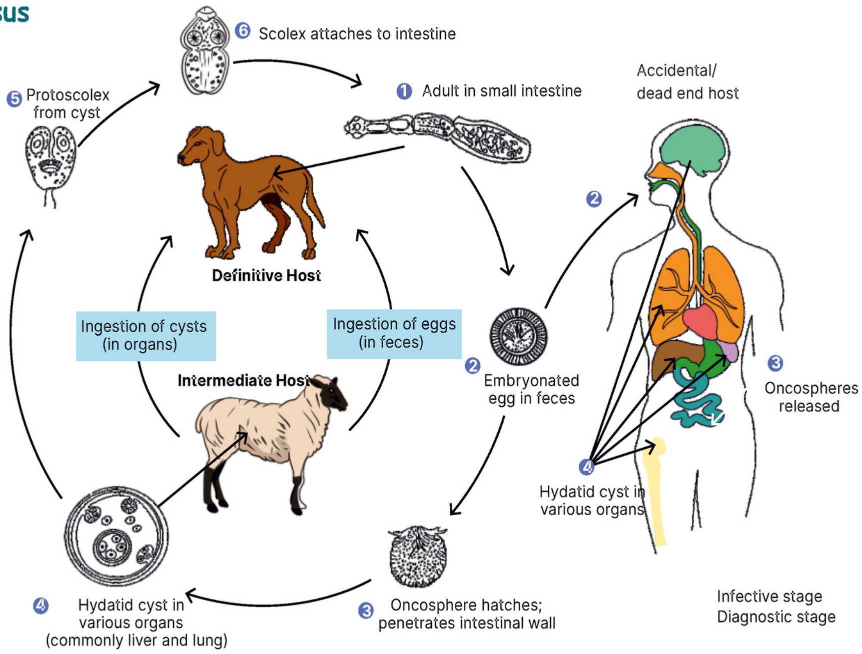
FMGE 2023

- Starry sky appearance is also seen in:



NEET PG 2020
FMGE 2021

Echinococcus Granulosus
Life Cycle



Yourwish

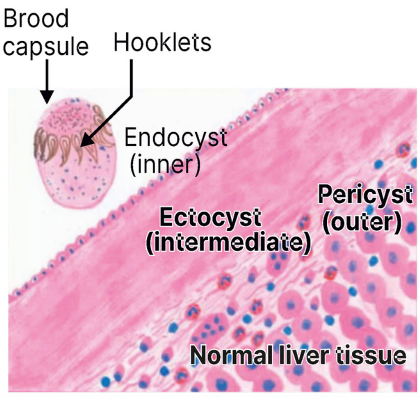
Yourwish

Hydatid Cyst

- MC site- Liver
- 2nd MC site- Lungs
- Usually detected on ultrasound or abdominal imaging.
- **FNAC: Contraindicated** d/t the risk of:
  - Rupture of the cyst releases fluid
  - Leads to a severe allergic reaction
  - Can cause anaphylactic shock
  - May lead to death
- **Casoni Test**
- Skin test using hydatid fluid
- Risk of **anaphylaxis**

Structure Of Hydatid Cyst

- A hydatid cyst has three layers.

Layer	Origin	Feature	Image
Pericyst	Host derived	Inflammatory tissue • Produced by the host's inflammatory response • Contains fibrous tissue and inflammatory cells	
Ectocyst	Parasite	Pink painted appearance • Outer parasite layer • Appears like a pink-painted wall	
Endocyst	Parasite	Germinal layer • Produces brood capsules that contain hooklets (Zn stain pos+) • Forms scolices (larval heads)	

Treatment

- **Medical Treatment-** Albendazole
- **Surgical Treatment-** PAIR Technique
  - PAIR = Puncture, Aspiration, Injection, Re-aspiration
  - Purpose: Prevent anaphylaxis & kill scolices and brood capsules

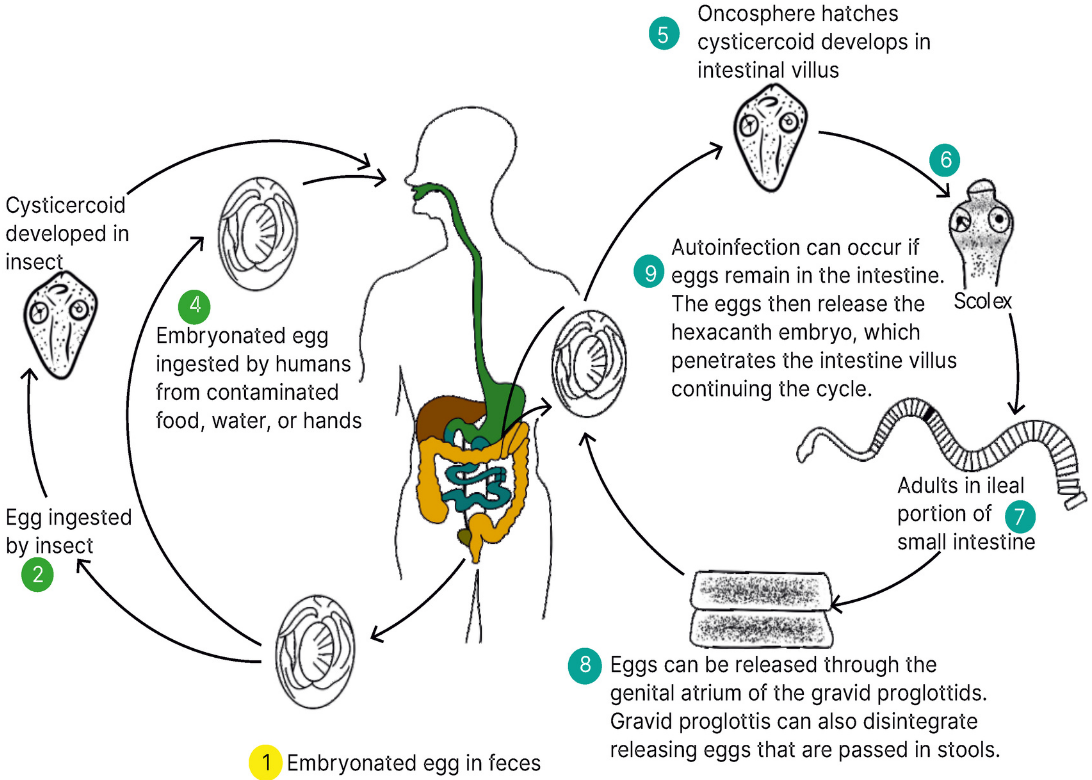
Step	Procedure
P	Puncture the cyst carefully
A	Aspirate cyst fluid
I	Inject scolicidal agent (95% ethanol)
R	Re-aspirate dead parasites

Echinococcus Multilocularis

NEET PG 2023
FMGE 2019, 2022

- Also causes **hydatid cyst disease**
- **Characteristic Feature:** Multiloculated cysts & Alveolar hydatid cyst
- MC site- Liver
- 2^{nd} MC site- Lungs

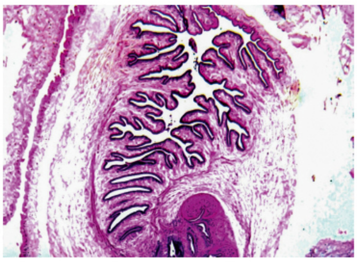
Life Cycle Of H Nana

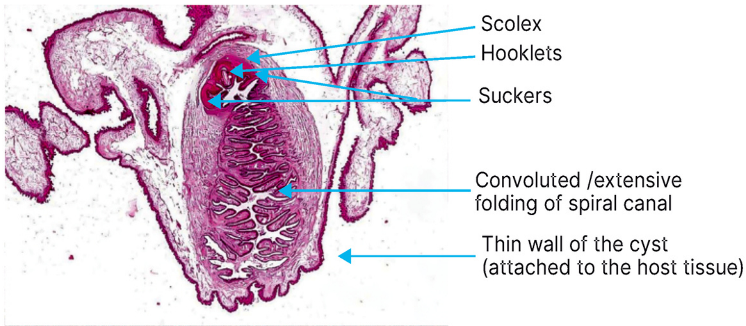


Treatment Of Cestodes

Parasite	Treatment
H nana	Praziquantel
H Diminuta	Praziquantel
D Latum	Praziquantel
Taenia solium	Praziquantel
Taenia saginata	Praziquantel
Echinococcus	Albendazole + Surgery (PAIR)

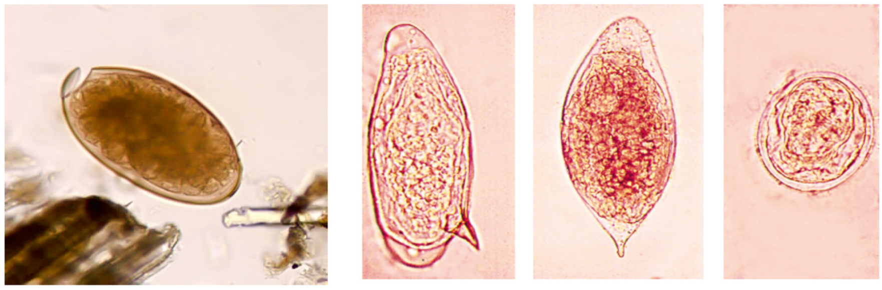
Cysticercus Cellulosae





- Larval stage of **Taenia solium**
- HPE Features:
- Convoluted structure
- Seen in neurocysticercosis

FMGE 2023
AIIMS 2022



TREMATODES (FLUKES)

00:22:15

Members Of Trematodes

- Definitive host - Humans
- 1st intermediate host - Snail

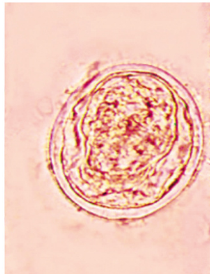
Parasite	Disease	Site	Second Intermediate Host
Schistosoma	Blood fluke	Blood vessels	None
Paragonimus westermani	Pulmonary fluke	Lung	Crab / Crayfish
Clonorchis sinensis	Chinese liver fluke	Liver	Fish
Opisthorchis	Liver fluke	Liver	Fish
Fasciola hepatica	Sheep liver fluke	Liver	Fresh aquatic plants
Fasciolopsis buski	Intestinal fluke	Intestine	Fresh aquatic plants

Life Cycle (general)

LIFE CYCLE (GENERAL)	DETAILS	Eggs
Mode of Infection	Ingestion of contaminated food/water	
Infective Form	Metacercaria	
Adult Worm	Hermaphrodite Single worm = both male + female organs	
Eggs Characteristic	Operculated eggs (lid present)	
Mnemonic: STD	**S**pirometra **T**rematodes **D**iphyllobothrium latum	

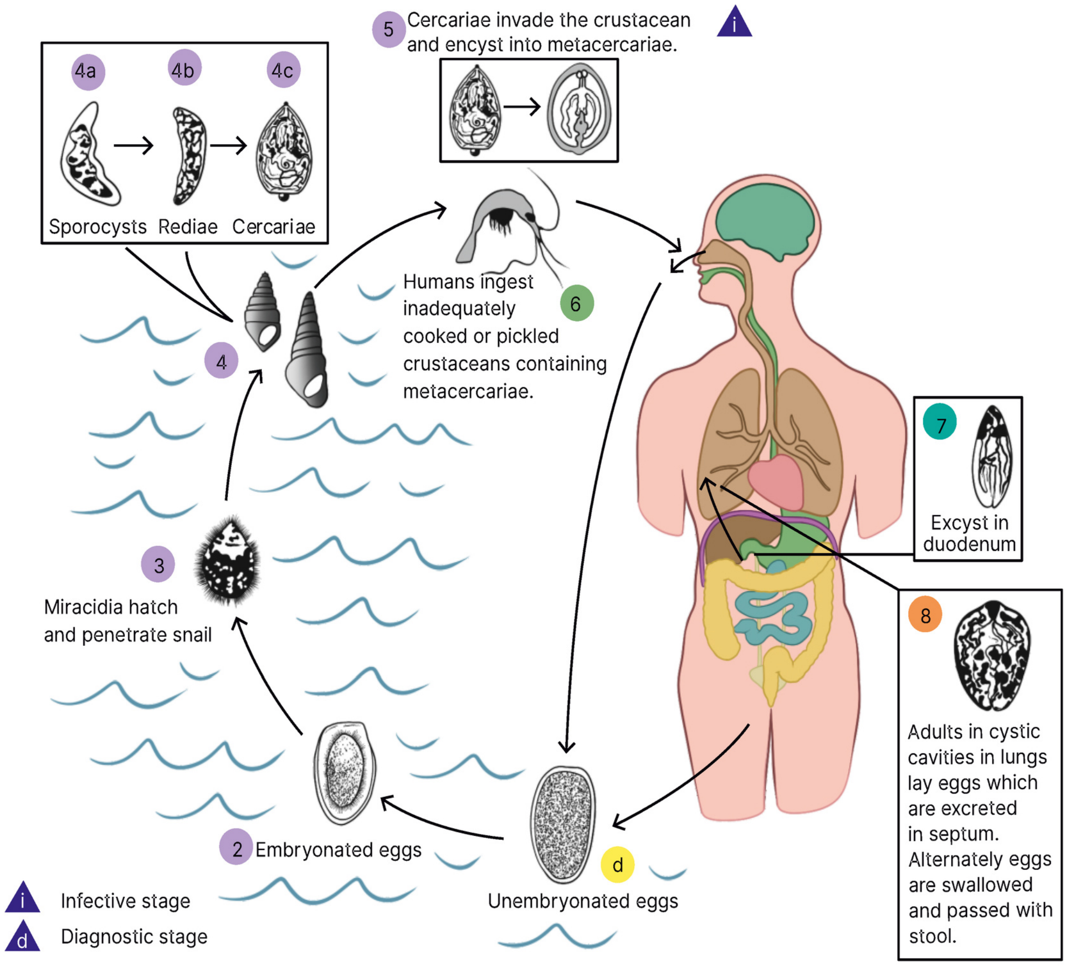
Yourwish

Life Cycle Schistosoma

Feature	Schistosoma		
Entry	• Skin penetration		
Infective form	• Cercaria		
Sex	• Separate male & female		
Egg type	• Spiny		
Egg identification	Schistosoma mansoni	Schistosoma haematobium	Schistosoma japonicum
	• Lateral spine 	• Terminal spine 	• Rudimentary/ small spine 

Trematodes – Identification And Life Cycle

Paragonimus Westermani



Yourwish

Yourwish

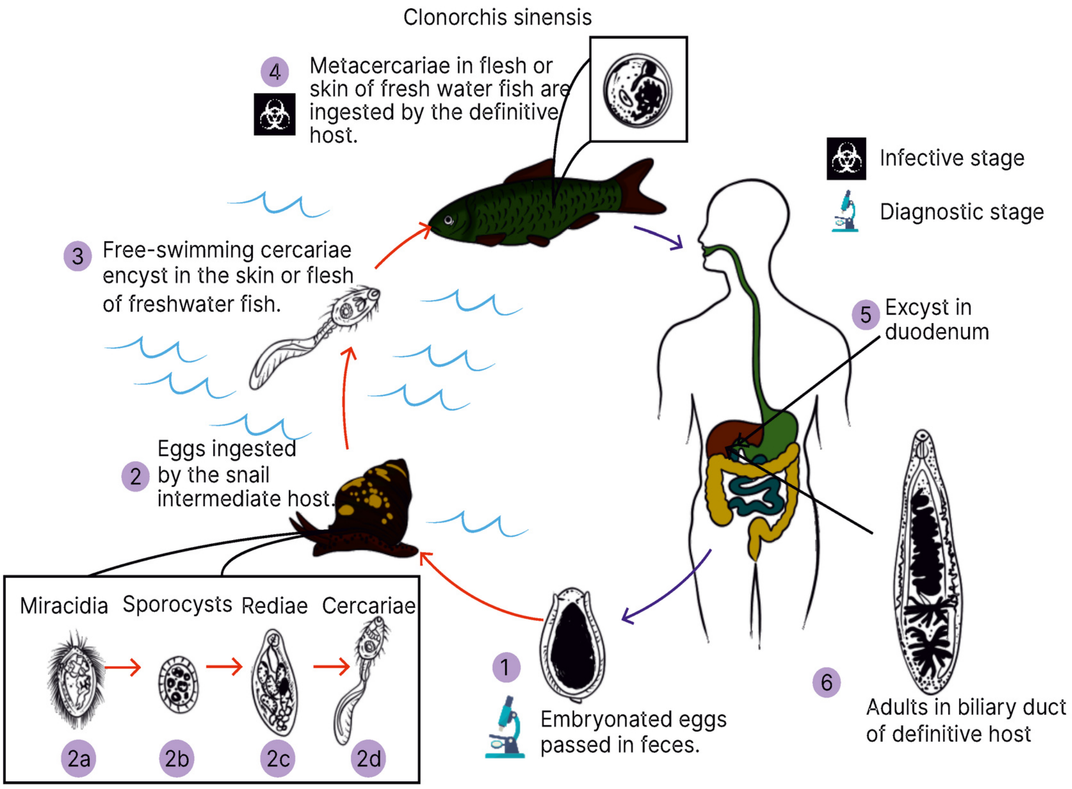
- Human host
- Snail present
- Second intermediate host → **Crab / Crayfish (Crustacean)**
- **Disease**
  - Pulmonary fluke- Involves the lungs

Developmental Stages In Trematodes

Stage	Meaning
M	Miracidium
C	Sporocyst
R	Redia
C	Cercaria
M	Metacercaria

Clonorchis

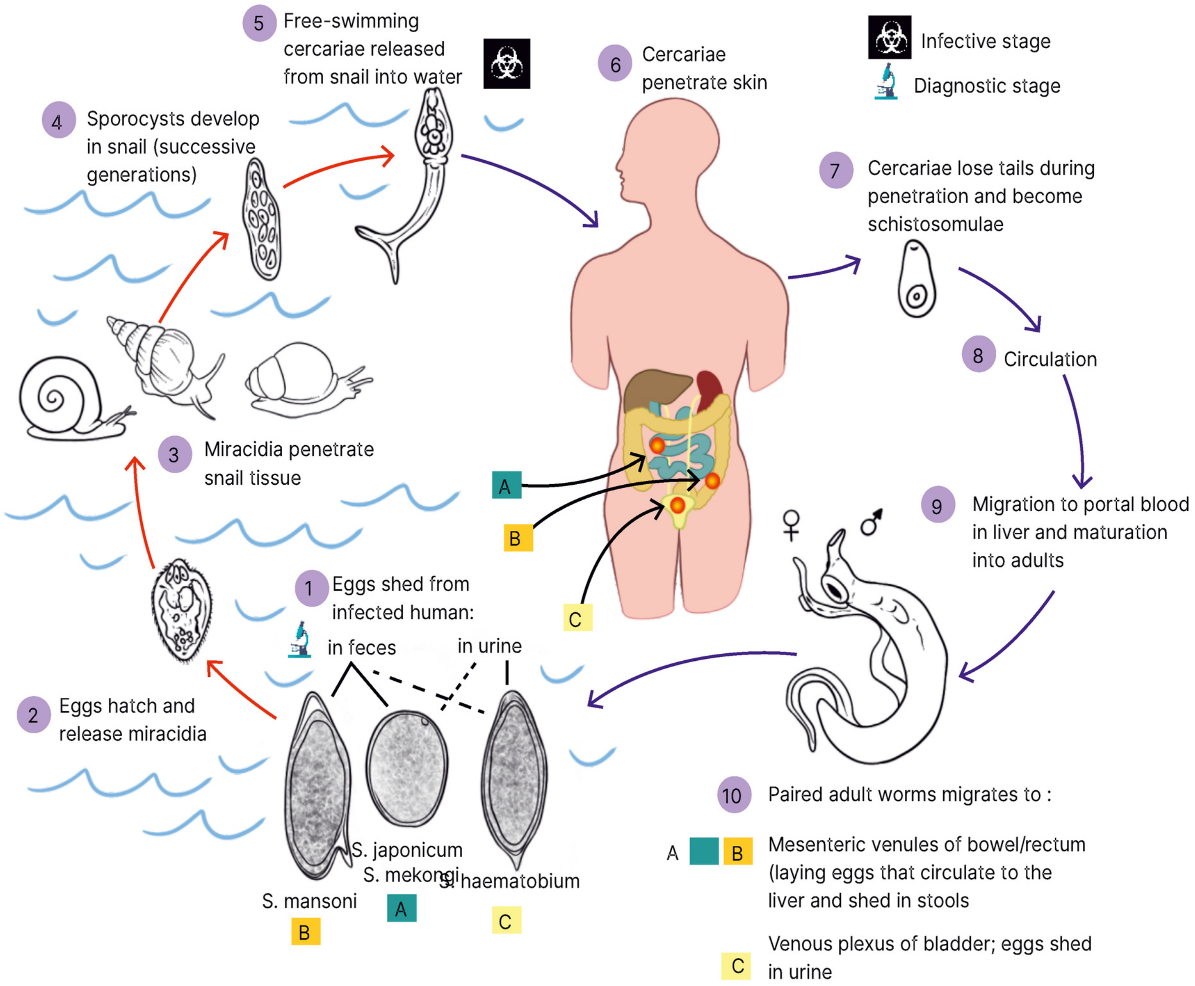
NEET PG 2023



Schistosoma

- Schistosoma **does not follow M-C-R-C-M**.
- Redia stage absent
- Metacercaria absent
- Cercaria is the infective stage

Stage	Meaning
M	Miracidium
C	Sporocyst
C	Cercaria



Clinical Features Of Trematodes

Schistosoma (blood Fluke)

Species	Location	Organ Involved
S. haematobium	Vesical venous plexus	Urinary bladder Hematuria Cancer: SCC (more common) > TCC (less common)
S. mansoni	Mesenteric venous plexus	Large intestine (Sigmoid colon + rectum)
S. japonicum	Mesenteric venous plexus	Small intestine (Ileocecal region)

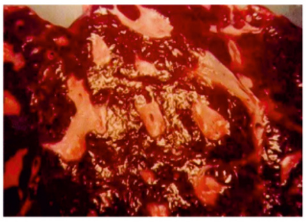
Schistosomiasis / Bilharziasis

Acute Phase

- Called: **Katayama fever**
- Symptoms:
  - Fever
  - Body aches
  - Serum sickness-like symptoms

Chronic Phase

- **Liver Findings**
  - Pipe-stem fibrosis (periportal)
  - Granuloma formation



Parasite	Common Name	Site	Key Features/Diseases
Paragonimus westermani	Pulmonary fluke	Lung	Lung infection Eggs in sputum/stool
Clonorchis/Opisthorchis	Chinese liver fluke	Bile ducts	Cholangitis Cholangiocarcinoma
Fasciola hepatica	Sheep liver fluke	Liver	RUQ pain + Jaundice Halzoun (pharyngeal edema → gasping; Halfna)
Fasciolopsis buski	Intestinal fluke	Small intestine	-

AIIMS 2021
INICET 2024

Other Liver Flukes

Parasite	Name
Clonorchis sinensis	Chinese liver fluke
Opisthorchis felineus	Cat liver fluke
Fasciola hepatica	Sheep liver fluke
Fasciola gigantica	Giant liver fluke

Intestinal Trematodes

- Most infections are in the **small intestine**
- **Exception**
  - Gastrodiscoides hominis - involves the large intestine

Treatment Of Trematodes

Parasite	Drug
Most trematodes	Praziquantel
Fasciola hepatica	Triclabendazole

NEMATODES (ROUNDWORMS)

00:37:22

- Classification based on habitat and mode of reproduction.

Classification

Based On Habitat

Habitat	Parasites
Somatic Worms (Roam in tissues)	• Filaria • Trichinella • Dracunculus

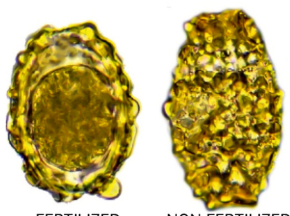
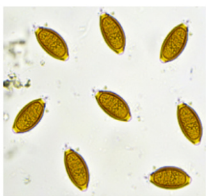
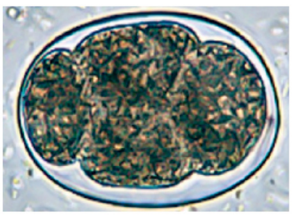
Intestinal - Large Intestine	• Enterobius • Trichuris trichiura
Intestinal - Small Intestine	• Roundworm • Hookworm • Strongyloides • LUNG MIGRATION PHASE (All have pulmonary phase)

Based On Reproduction

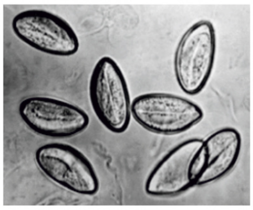
Reproduction Type	Key Feature	Parasites
Viviparous	• Directly produce larvae	• Filaria • Trichinella • Dracunculus
Oviparous	• Lay eggs	• Roundworm • Hookworm • Trichuris • Enterobius
Ovoviviparous	• Egg hatches immediately after laying • (Egg laid → Larva emerges instantly)	• Strongyloides

Eggs Of Nematodes

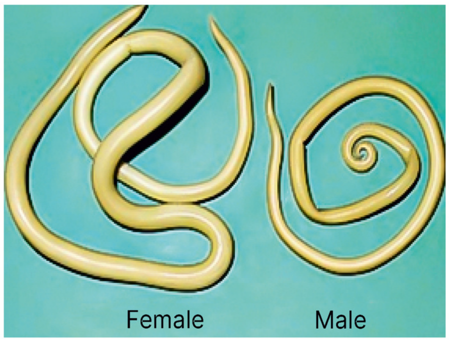
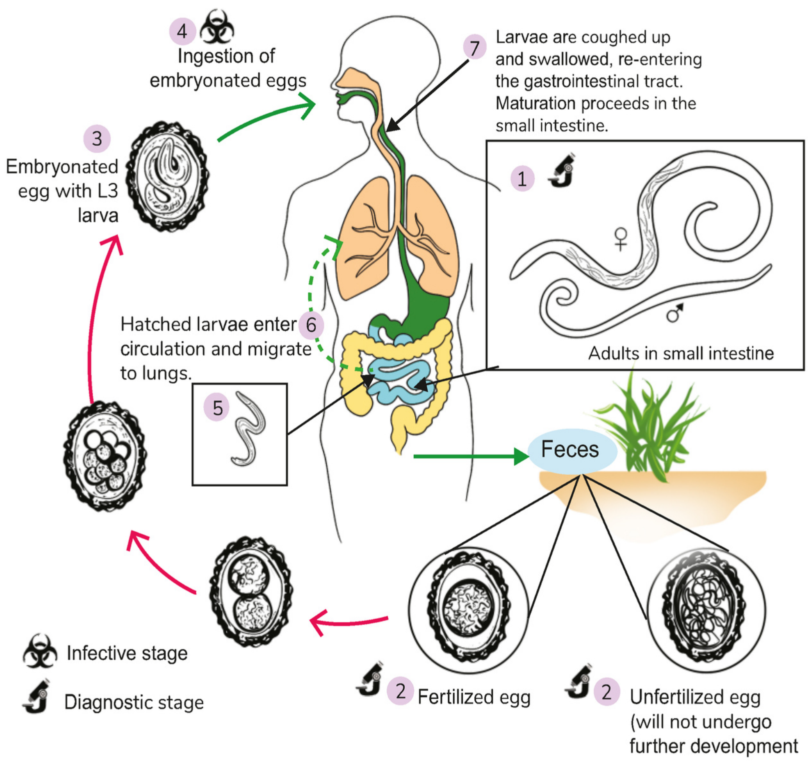
INICET 2024
AIIMS 2020, 2021

Parasite	Egg Type	Key Characteristics
Ascaris lumbricoides	• Fertilized egg	• Thick coat • Crescent-shaped clear space • Floats in saturated salt solution
 FERTILIZED NON FERTILIZED	• Unfertilized egg	• Thin shell • No crescent space • Does NOT float
Trichuris trichiura 	• Barrel- shaped	• Mucus plugs at both ends
Hookworm 	• Segmented egg	• Multiple internal divisions

Yourwish

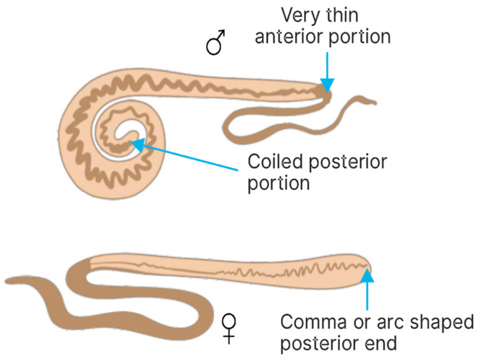
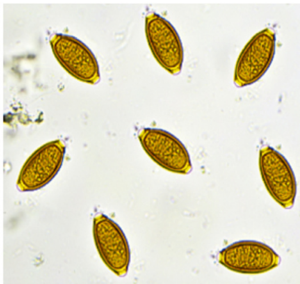
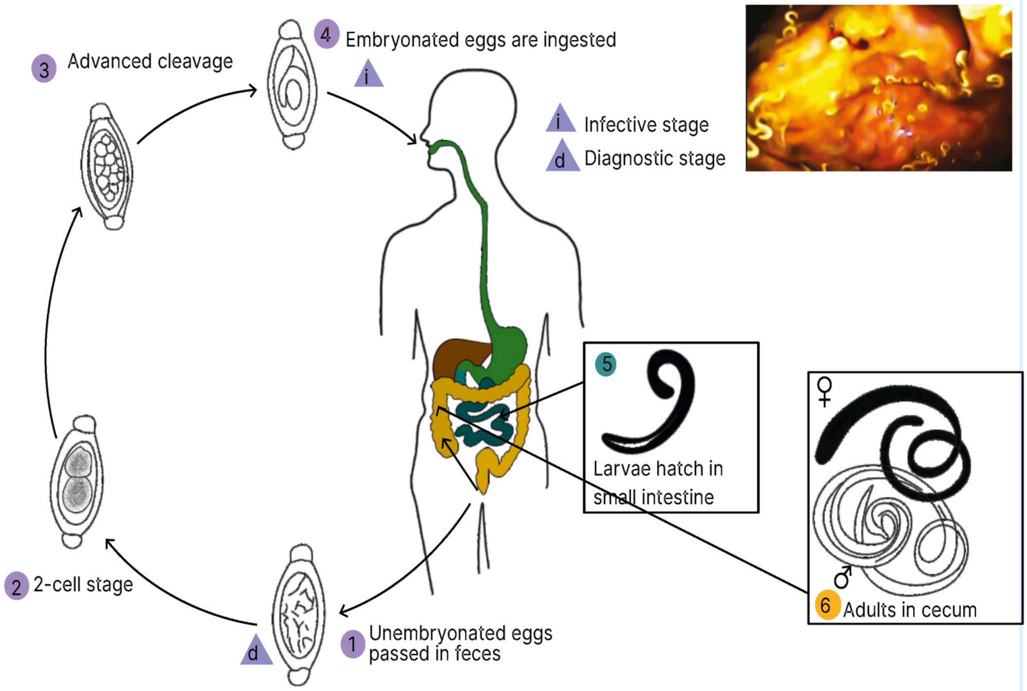
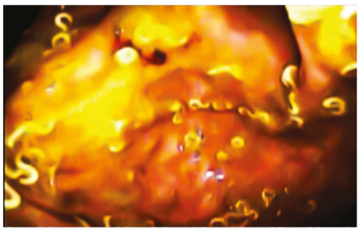
Enterobius vermicularis 	• Plano-convex • D-shaped	• One side flat • Other side convex • Tadpole larva inside

Ascaris Lumbricoides

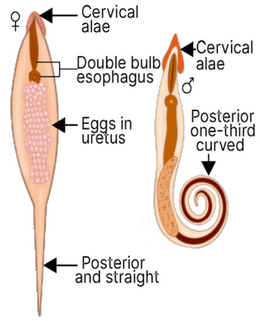
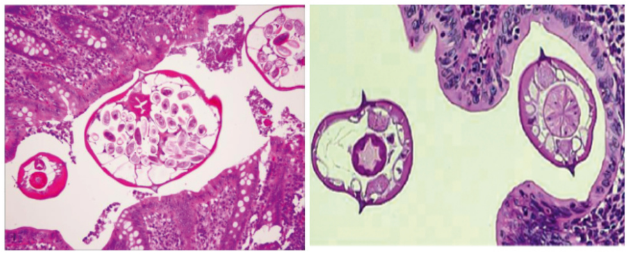
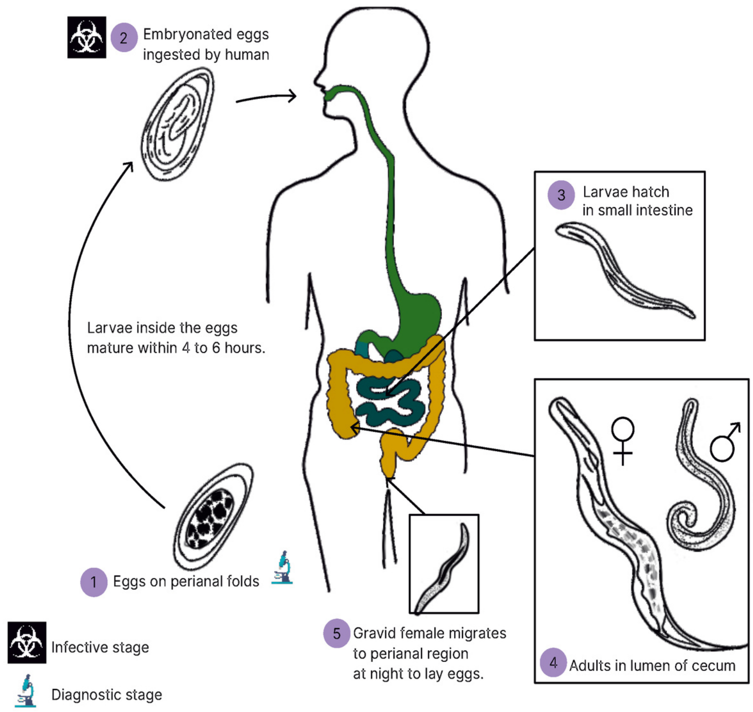
Mode of Transmission	• Contaminated food/water
Infective Stage	• Embryonated egg
Identification	• Round worm (cross-section of the body is round) • Male- Posterior coiled end • Female- Larger 
Life cycle	Ascaris lumbricoides 
Diagnostic Stage	• Fertilized & unfertilized eggs (stool)
Clinical Features	• Intestinal: Malabsorption, diarrhea • Pulmonary: Cough, eosinophilia, Loefler's pneumonitis
Rx	• Albendazole

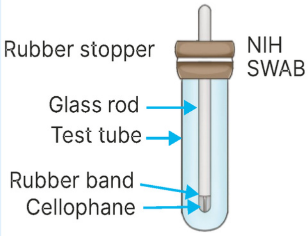
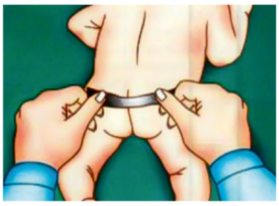
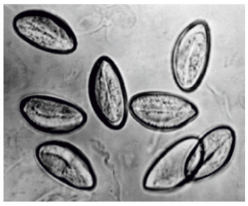
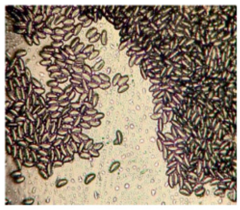
Yourwish

Trichuris Trichiura

Mode of Transmission	• Ingestion
Infective Stage	• Embryonated egg
Identification	• Whipworm (Looks like a hunter's whip in the anterior) • Male- Posterior end coiled • Female- Larger • Eggs- Barrel-shaped with mucus plugs 
Life cycle	
Diagnostic Stage	• Unembryonated egg
Clinical Features	• Dysentery • Bloody diarrhea • Rectal prolapse • Coconut cake rectum (endoscopy) 
Rx	• Albendazole

Enterobius Vermicularis

Mode of Transmission	• Ingestion
Infective Stage	• Embryonated egg
Identification	• Grows in the vermiform appendix • Pinworm/Threadworm (presence of cervical alae on the head) • Male- Posterior end coiled • Female- Larger • Eggs- D-shaped plano convex eggs NEET PG 2019, 2020 FMGE 2020 
Life cycle	 • Male worm dies after mating • Females lay eggs in the perianal area at night **Autoinfection** • **Retroinfection** ○ Eggs laid near the anus: Travel **back into the intestine** ○ Cause: Reinfection • **Hand-to-mouth infection** ○ Kid scratches the perianal area ○ Eggs stick to nails ○ Eggs enter the mouth during eating

Diagnostic Stage	• Embryonated egg
Lab investigation	• Adults- NIH swab • Children- Scotch tape method FMGE 2020  
Clinical Features	• Perianal pruritus (night itching) • Female migrates to lay eggs at night
Rx	• Albendazole

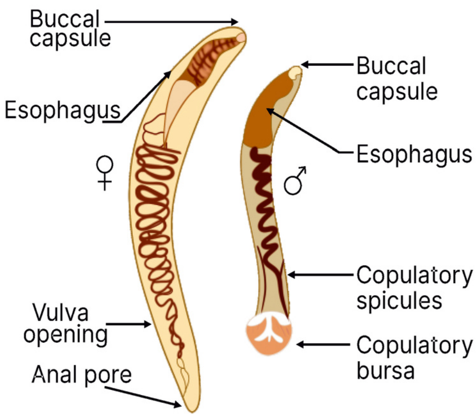
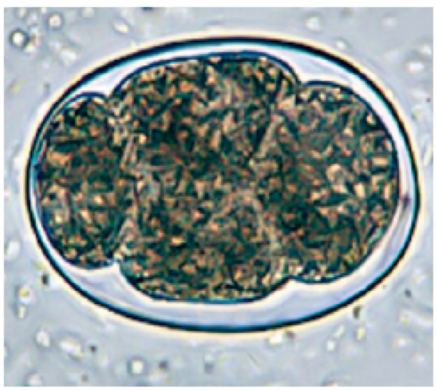
Important Information

- ***Organisms Transmitted Through Contaminated Food And Water***
  - *Ascaris lumbricoides*
  - *Trichuris trichiura*
  - *Enterobius vermicularis*

Hookworms

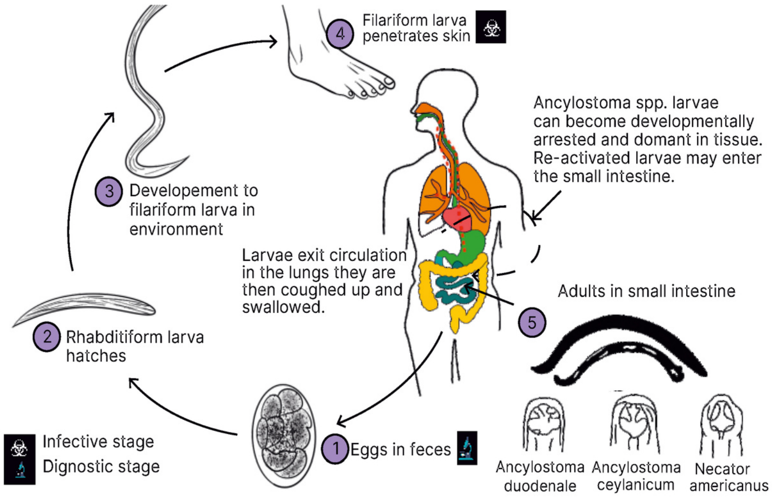
00:54:17

- ***Ancylostoma duodenale***- Old world
- ***Necator americanus***- New world

Mode of Transmission	• Skin (Barefoot on contaminated soil)
Infective Stage	• Filariform larva
Identification	• Male- Umbrella-like expansion at the posterior end • Female- Larger • Eggs- Segmented egg  

Yourwish

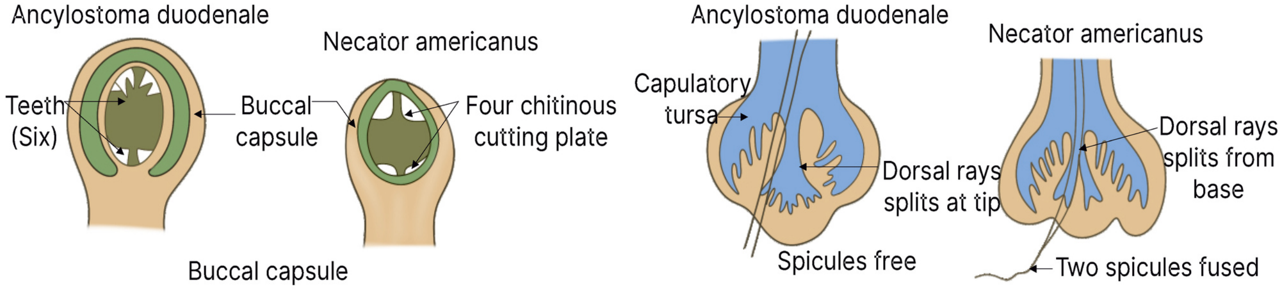
Yourwish

Life cycle	
Diagnostic Stage	• Unembryonated egg (stool)
Clinical Features	• **Skin**: Creeping eruption, Ground itch • **Pulmonary**: Lung migration • **Intestinal**: IDA (blood sucking) 
Rx	• Albendazole

Difference Between Ancylostoma Duodenale Vs Necator Americanus

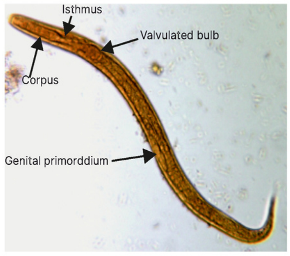
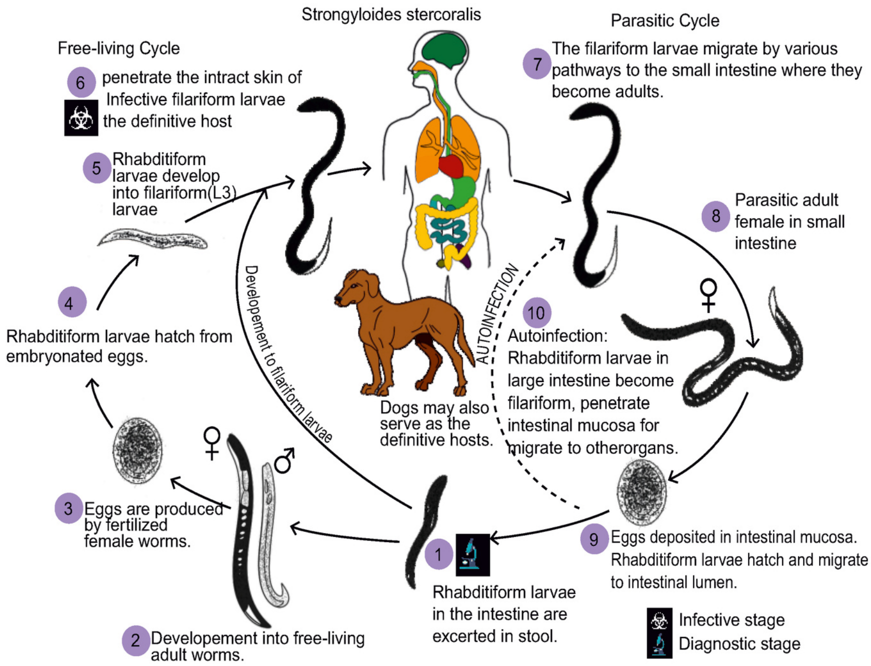
Feature	Ancylostoma duodenale	Necator americanus
Eggs	Same	Same
Rhabditiform larva	Same	Same
World	Old world	New world
Head structure	6 teeth	4 Chitinous plates
Tail spicules	Two free spicules	Two fused spicules
Pathogenicity	More pathogenic	Less pathogenic

NEET PG 2018, 2024, 2025
AIIMS 2019



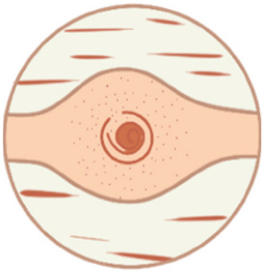
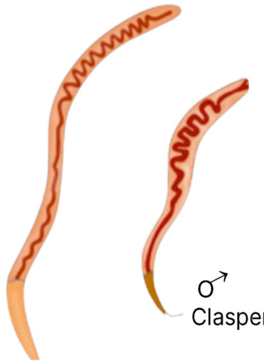
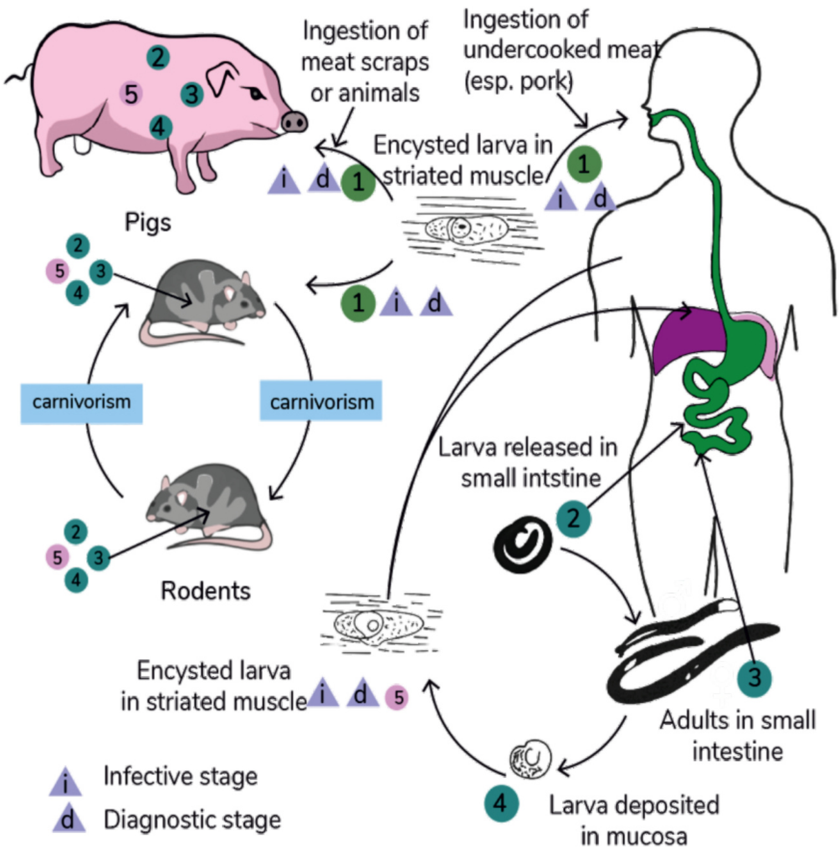
Strongyloides Stercoralis

01:00:15

Mode of Transmission	• Skin
Infective Stage	• Filariform larva NEET PG 2021 AIIMS 2018
Identification	• Smallest nematode • Tail end- pointed • Head end- Double bulb esophagus 
Life cycle	• Parthenogenesis- Capable of asexual reproduction • Direct cycle: Rhabditiform larva → Filariform larva • Indirect cycles: Rhabditiform larva → Adult → Egg → Filariform larva • Auto-infection 
Diagnostic Stage	• Rhabditiform larva
Clinical Features	• **Skin**: Cutaneous Larva Migrans (serpiginous) • **Pulmonary**: Lung migration • **Intestinal**: Small intestine
Rx	• Ivermectin

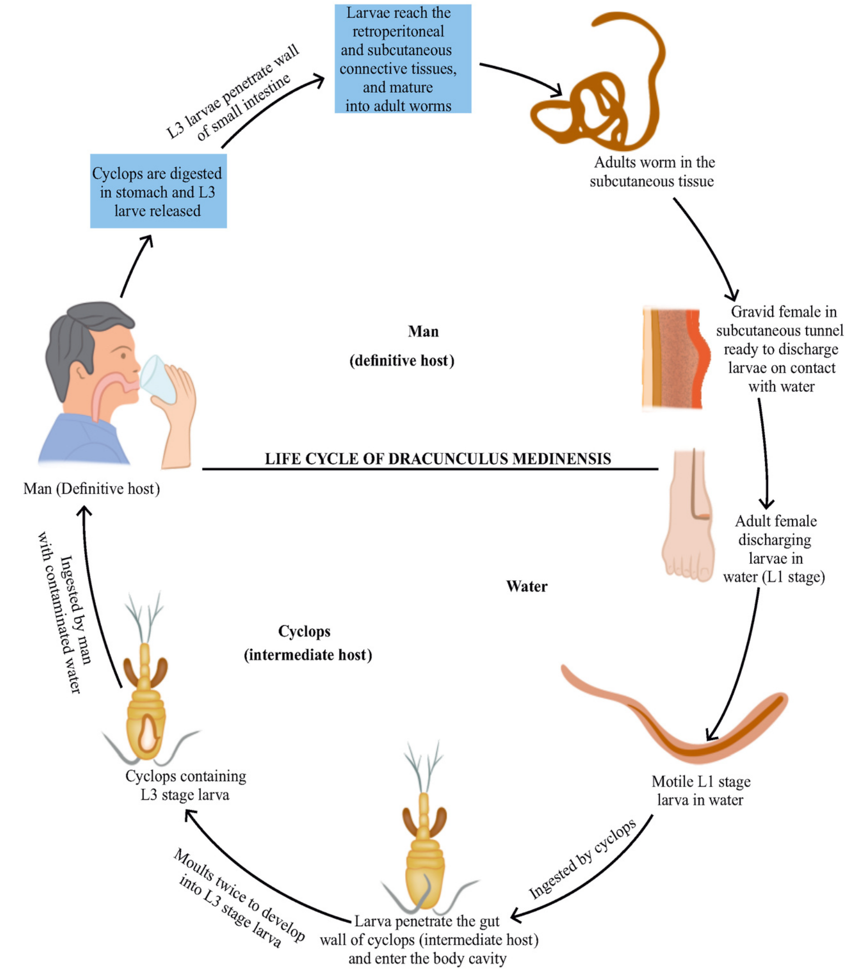
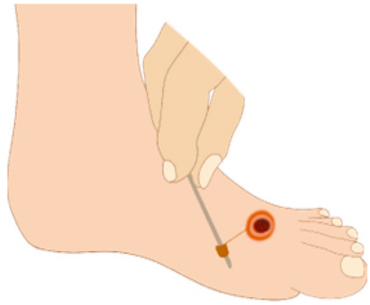
Trichinella Spiralis

Mode of Transmission	• Ingestion of meat • Host- Pig • Alternate/dead end- Human

Infective Stage	• Encysted larva • Found inside a muscle 
Identification	• Females- Larger • Male- 2 claspers at the posterior end 
Life cycle	
Diagnostic stage	• Biopsy • Insertion of the deltoid
Clinical Features	• Skeletal- Muscle pain • Cardiac muscle- Myocarditis
Rx	• Albendazole

Yourwish

Dracunculus Medinensis

Mode of Transmission	• Drinking dirty water with cyclops having L3 larvae
Infective Stage	• L3 larva
Identification	• Females- Larger • Male- 2 claspers at the posterior end
Life cycle	
Diagnostic stage	• **L1 larva** emerging from skin
Clinical Features	• An adult female migrates to the skin and forms a subcutaneous tunnel • A worm emerges from a skin lesion 
Rx	• Metronidazole
Key features	• **Eradication program**- Abate larvicide

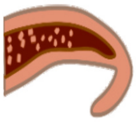
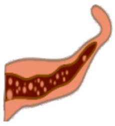
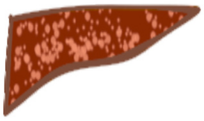
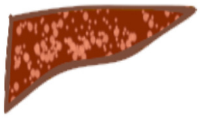
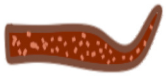
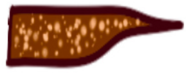
Yourwish

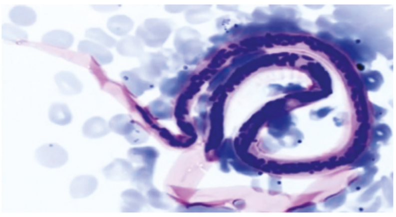
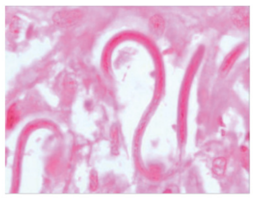
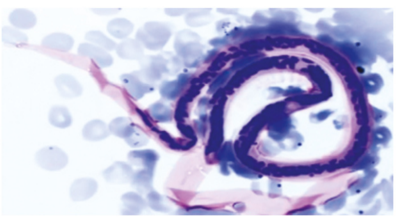
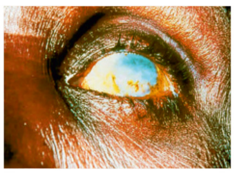
Yourwish

Filarial Nematodes

01:10:30

NEET PG 2020, 2021, 2022, 2023

Species	Wuchereria bancrofti	Brugia malayi	Loa Loa	Mansonella perstans	Mansonella ozzardi	Onchocerca volvulus
Shape						
Posterior end						

Parameter	Wuchereria bancrofti	Brugia malayi/timori	Loa loa	Onchocerca volvulus
Category	Sheathed (LBDW)	Sheathed (LBDW)	Sheathed (LBDW)	Unsheathed
Vector	Culex/Anopheles/ Aedes	Mansonia (malayi) Anopheles (timori)	Deer fly	Black fly 
Periodicity	Nocturnal	Nocturnal	Diurnal	Non-periodic
Tail Nuclei	None (Whoosh - nuclei disappear) 	2 nuclei (Bi → Brugia)	Continuous line (L-line)	- 
Clinical Features	Elephantiasis (entire limb) Chyluria (milky urine) Hydrocele Filarial dance sign (USG scrotum) NEET PG 2020, 2021, 2022 FMGE 2019 INICET 2024   	Elephantiasis (below knee only) No hydrocele/ genitals	Calabar swelling (fugitive) African eye worm (visible in the eye) Redness/Itching/ Fever FMGE 2021 AIIMS 2019  	River blindness (sclerosing keratitis) Leopard skin LN- Hanging groin  

Diagnostic Tests	Night blood smear DEC provocation test Ab- Non-specific Ag- OG4C3Ag; AD12Ag	Night blood smear	Day blood smear Adult worm in eye	Mazzotti test (DEC patch test)
Pathogenesis	Lymphatic obstruction	Lymphatic obstruction	Hypersensitivity	Skin/eye damage
Treatment	DEC	DEC	DEC	Ivermectin (River→Iver)

IMPORTANT PARASITOLOGY REVISION LISTS

01:21:26

Category	Parasites
NON-BILE STAINED EGGS (NEHA)	• N: Necator americanus • E: Enterobius vermicularis • H: Hymenolepis nana • A: Ancylostoma duodenale
AUTO-INFECTION PARASITES (CHEST)	• C: Cryptosporidium • H: Hymenolepis nana • E: Enterobius vermicularis • S: Strongyloides stercoralis • T: Taenia solium
DOES NOT FLOAT (SSS)	• U- Unfertilized egg (Ascaris) • L- Larva strongyloides • T- Taenia egg • O- Operculated egg (Trematodes)
SMALL INFECTIVE DOSE (CHHOTA SMALL)	• Cryptosporidium • Entamoeba histolytica • Enterohemorrhagic E. coli (EHEC) • Shigella • Giardia lamblia

DRUGS OF CHOICE IN PARASITOLOGY

01:23:48

Group	Parasite/Disease	Treatment
PROTOZOA	**Entamoeba histolytica**	Diarrhea- Metronidazole + Paromomycin (luminal) Liver abscess: Metronidazole + Chloroquine
	Balantidium coli	Diarrhea- **Doxycycline**
	Giardia lamblia	**Metronidazole**
	Trichomonas vaginalis	**Metronidazole (Partner treatment)**
FREE LIVING AMOEBA	**Naegleria/Acanthamoeba**	**Multidrug therapy**

TRYPANOSOMA	**T. cruzi** (Chagas)	**Benznidazole**
	T. b. gambiense	**Pentamidine**
	T. b. rhodesiense	Early: **Suramin** Late: **Melarsoprol**
COCCIDIAN	**Cryptosporidium**	**Nitazoxanide**
	Cyclospora/Isospora	**Cotrimoxazole**
TOXOPLASMA GONDII	-	**Pyrimethamine + Sulfadiazine**
LEISHMANIA	**L. donovani** (Kala-azar)	**Liposomal Amphotericin B**
	Post Kala-azar Dermal	**Oral Miltefosine**
MALARIA	**P. vivax/ovale**	**Chloroquine** (blood) + **Primaquine** (hypnozoites)
	P. falciparum	**ACT** (Artemisinin Combination) **Primaquine** (gametocytes)
BABESIA	-	**Azithromycin + Atovaquone**
CESTODES	General (Tapeworms)	Praziquantel
	Echinococcus	Albendazole + PAIR
	Neurocysticercosis (T. solium)	Albendazole + Phenytoin/ Steroids
TREMATODES	General	Praziquantel
	Fasciola hepatica	Triclabendazole
NEMATODES	Most	Albendazole
	Strongyloides	Ivermectin
	Onchocerca	Ivermectin
	Filarial worms	DEC
	Dracunculus (Guinea worm)	Metronidazole

PYQs

01:28:08

Q. A patient who has a pet dog at home complains of hypochondriacal pain. Radiological imaging shows a multilocular cyst within the liver. The organism involved is?

a. Echinococcus granulosus

b. Entamoeba histolytica

c. Strongyloides stercoralis

d. Ancylostoma duodenale

Ans: a. Echinococcus granulosus

Q. An HIV-positive patient with a history of gastrointestinal helminth infection has a stool sample that shows 200-micron larvae but no eggs. Identify the parasite:

a. Ascaris
b. Strongyloides
c. Ancylostoma
d. Schistosoma

Ans: b. Strongyloides

Q. A 5-year-old child presents with nocturnal perianal itching. The image below shows the organism identified on an adhesive tape test. Mother saw a worm coming out of the anal canal. What is the most likely causative agent?

a. Enterobius vermicularis
b. Ancylostoma duodenale
c. Hymenolepis nana
d. Trichuris trichiura

Ans: a. Enterobius vermicularis

Q. Microfilariae with a sheathed tail and two nuclei at the tail are suggestive of?

a. Wuchereria bancrofti
b. Brugia malayi
c. Loa loa
d. Onchocerca volvulus

Ans: b. Brugia malayi

5. IMMUNOLOGY

NATURAL KILLER CELLS

FMGE 2019 00:00:30

Function	• Kills cancer & viruses
Structure	• Activating arm- Responsible for killing • Inhibiting arm- Prevents the killing of normal self-cells

Mechanism	• Normal self-cell carries = MHC I
	• If MHC I is present
	  ○ NK cells recognize it as self
	  ○ The inhibiting arm comes out
	  ○ No killing occurs
	• If the cell is virus-infected or has a tumor
	  ○ Expression of MHC I decreases
	  ○ Activating arm = NKG2D comes out
	  ○ NK cells kill the infected/tumor cells
	• NK cells provide immunity against tumors & viruses

Other names	• ILCs = Innate lymphoid cells (Part of innate immunity) • Non-B, non-T cells (Null cells) • Large granular lymphocytes
Controlled by	• Interleukin- 2, 12, and 15
Positive CD markers	• CD16, CD56, and CD94

LYMPHOCYTES

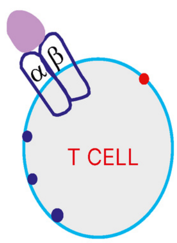
00:02:35

- Lymphocytes in the blood
  - T lymphocytes- Majority
  - B lymphocytes

T- Lymphocytes

AIIMS 2018

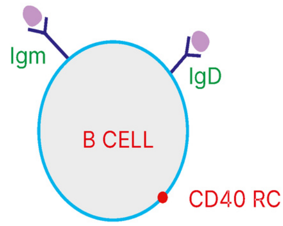
- T-cell receptor
  - Made up of 2 chains- Alpha chain & Beta chain
- CD markers
  - CD1 to CD8
  - Cd28
- Pan T-cell marker- CD3
  - Present at every stage- Immature T cell & Mature T cell
- Signal-carrying marker- CD3
- Helper T cells- CD4
- Cytotoxic T cells- CD8



- Normal CD4:CD8 ratio- 2:1
- Ratio decreases
    - Viral infections
    - HIV- Because HIV attacks CD4 T cells
- Ratio increases >3.5
    - Sarcoidosis

B Lymphocytes

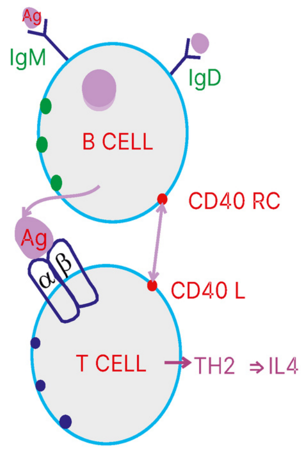
- B-cell receptor- IgM & IgD
- CD markers
    - CD10- Also called CALLA (Common ALL antigen)
    - Cd19
    - Cd20
    - Cd21
    - Cd22
    - Cd23
    - Cd40
- Pan B-cell marker- CD19
- Signal-carrying marker- CD79a/b
- EBV entry into B cell- Via CD21



B-cell and T-Cell Interaction

AIIMS 2023

- Initial event- Signal 1
    - Antigen comes to the body
    - B cell takes the antigen & gives it to the T cell
- Need for isotype switching
    - B cell initially has IgM and IgD
    - But needs the entire GAMDE spectrum
    - Signal 2
    - Interaction of CD40 on B cells and CD40 ligand on T cells
- Signal 2
    - Interaction of CD40 on B cells and CD40 ligand on T cells
    - T cell converts into a T-helper 2 cell
    - Releases Interleukin-4
- Role of IL-4
    - Converts MD to GAMDE
    - This conversion is called isotype switching
- Causes of isotype switching
    - Interleukin-4
    - CD40-CD40L interaction



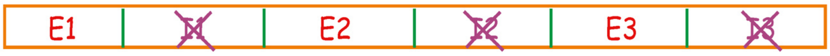
Aicd Enzyme

- B cells release enzyme AICD- Activation-induced cytidine deaminase
- Function
    - Also causes isotype switching
    - Helps change MD to GAMDE

Somatic Hypermutation
- A mutation occurs in the variable region of the B-cell receptor that helps convert MD to GAMDE
- Enzyme responsible- AICD

Affinity Maturation
- Newly formed antibodies have a very high affinity for the antigen
- They strongly bind to the bacteria/virus/antigen
- This is called affinity maturation

Alternate RNA Splicing
- Gene has Exons & Introns
- Splicing- Removal of introns



- Different combinations of exons can produce different antibodies
- This is called alternate RNA splicing

Flow of Antigen Presentation
- Antigen first gets picked up by an antigen-presenting cell
- APC presents the antigen to the T cell
- Antigen is presented on an MHC
- The T-cell receptor receives an antigen presented on MHC

Antigen-presenting Cells (APCs)
- Professional APCs
  - **D**endritic cells
  - **B** cells
  - **M**acrophages
- Skin dendritic cell- Langerhans cell
- Non-professional APCs
  - Endothelial cells
  - Epithelial cells
  - Fibroblasts

MHC
FMGE 2020
- Major histocompatibility complex
- Made by the HLA gene
- HLA gene is present on the short arm of chromosome 6

HLA Gene

Region	Subtypes	Function/Characteristics
Part 1 (Class I)	HLA-A, HLA-B, HLA-C	Makes MHC 1 molecules for antigen presentation
Part 3 (Class III)	-	Does not make MHC; produces complement proteins C2, C4, HSP, TNF-alpha
Part 2 (Class II)	HLA-DP, HLA-DQ, HLA-DR	Makes MHC 2 molecules for antigen presentation

- HLA matching in transplantation is done using ABC, DP & DQ

MHC I vs MHC II

Feature	MHC I	MHC II
HLA Gene Source	HLA gene Part 1 (Class I)	HLA gene Part 2 (Class II)
Structure	α1, α2, α3 + β2 microglobulin	α1, α2, β1, β2
Antigen Binding Site	Junction of α1 and α2	Junction of α1 and β1
Present on cells	All nucleated cells, platelets	Antigen-presenting cells (APCs)
Not Present On	RBCs (no nucleus), sperms	-
T-cell Presented To	CD8+ T cells (cytotoxic)	CD4+ T cells (helper)

- Rule of 8
  - MHC 1 → CD8
    → 1 × 8 = 8
  - MHC 2 → CD4
    → 2 × 4 = 8
  - CD4 : CD8 ratio = 2 : 1
    → 4 × 2 = 8
    → 8 × 1 = 8

T Cells

- Types
  - CD4- Helper T cell
  - CD8- Cytotoxic T cell

HELPER T CELLS

- CD4 cells
  - Called the master regulator of the immune system
- Types

T Helper 17	• T helper 17 makes Interleukin-17
T Helper 1	• Releases IL-1 & INF- ○ IL-2 also helps in further growth
T Helper 2	• Releases IL-4, IL-5, & IL-13 • Functions ○ IL-4- Causes isotype switching ○ IL-5- Causes eosinophil activation ○ IL-13- Causes mucus production • Seen in asthma ○ Eosinophils increased ○ IgE is formed by class switching ○ Mucus increased

Yourwish

CYTOTOXIC T CELLS

- Function- Involved in killing bacteria
- Mechanisms of killing
  - Apoptosis- By activating CD95
  - Perforin-granzyme pathway
    - → First, it makes perforation using perforin
    - → Then releases granzyme inside
    - → Bacteria dies

HYPERSENSITIVITY REACTIONS

00:20:00

- Total types- 5
- Classification- Gel and Coombs classification

Type I Hypersensitivity

FMGE 2020, 2021, 2023
NEET PG 2020
AIIMS 2021

- AKA Anaphylaxis
- Associated with T helper 2 cells
- Mnemonic- ABCD
  - A = Allergies
  - B = Bronchial asthma
  - C = Casoni's test
  - D = Drugs
- Examples
  - Allergic rhinitis
  - Allergic dermatitis
  - Allergic conjunctivitis
    - → Vernal keratoconjunctivitis
    - → DOC: Olopatadine
- Mast cell stabilizer
- Antihistamine
  - Atopy
    - → Allergy running in the family
    - → Determined by Ch5
  - Drug allergy- Example: Penicillin
  - Bronchial asthma
  - Casoni's test
    - → For hydatid cyst
    - → PK reaction
    - → Theobald Smith phenomenon
- Pathogenesis
  - Via T helper 2 cells
  - IL-4- Isotype switching
  - IL-5- Eosinophils
  - IL-13- Mucus production

Type II Hypersensitivity

FMGE 2021
AIIMS 2021

- AKA Cytotoxic
- **Mnemonic- My Blood Group Is Rh positive**
  - My = Myasthenia gravis
  - Blood = Blood transfusion reaction
  - Group = Goodpasture disease
  - G = Graves' disease
  - Is = Immune hemolytic anemia, Immune thrombocytopenic purpura
  - Rh = Rh incompatibility, Rheumatic heart disease
  - P = Pemphigus, Pernicious anemia

Type V Hypersensitivity

FMGE 2020, 2024

- Newer classification
  - If antibodies are against cellular receptors
- Examples
  - Myasthenia gravis- Against the acetylcholine receptor
  - Grave's disease- Against the TSH receptor

Type III Hypersensitivity

FMGE 2019

- AKA Immune complex
- Due to the antigen-antibody complex
- Stages
  - Formation of an immune complex- Antigen and antibody meet in the blood
  - Deposition of an immune complex- Can deposit in the Kidney, GIT, Joints, or any organ
  - Complement activation- Leads to clinical features; Time required- 10–14 days
- **Mnemonic- SHARP**
  - S = Serum sickness
  - S = SLE
  - S = Schick test
  - H = Henoch-Schonlein purpura
  - A = Arthus reaction
  - R = Reactive arthritis
  - R = Rajiv assay
  - P = Post-streptococcal glomerulonephritis
  - P = Polyarteritis nodosa
- Arthus reaction
  - Localized immune complex disease
  - Complex deposits only in the skin
- PSGN
  - Starts with a streptococcal sore throat
  - Ends with cola-colored urine
  - Duration- 10–14 days

Difference Between Type II and Type III

Type II	Type III

• Antigen is fixed
• Examples
  ○ Acetylcholine receptor
  ○ TSH receptor
  ○ Parietal cell
  ○ Pemphigus antigen in skin
	• Antigen is mobile
	• Antigen and antibody both move in the blood and then meet

Type IV Hypersensitivity

AIIMS 2021

- AKA Delayed hypersensitivity
- Develops after weeks to months
- Associated with T helper 1 cells
- Main mediator- Interferon-gamma
  - Granuloma formation
- Examples
  - Tuberculosis
  - Leprosy
  - Temporal arteritis / giant cell arteritis
  - Crohn's disease
  - Multiple sclerosis
  - Contact dermatitis
- Skin tests
  - Mantoux test
  - Lepromin test
- Important caution
  - Type I hypersensitivity uses T helper 2 cells
  - Type IV hypersensitivity uses T helper 1 cells

Leprosy Reactions

- Rule of 5
  - Type 1 lepra reaction = Type 4 hypersensitivity
    $\rightarrow 1 + 4 = 5$
  - Type 2 lepra reaction = Type 3 hypersensitivity
    $\rightarrow 2 + 3 = 5$

Contact Dermatitis

- MC causes in India
  - Detergents
  - Artificial jewelry- D/t Nickel, Cadmium
  - Bindi
  - Sindoor
- MC cause Worldwide- Poison ivy

Mixed Hypersensitivity Conditions

- Rheumatoid arthritis- Type III + Type IV
- Hypersensitivity pneumonitis- Type III + Type IV
- SLE- Type II + Type III

AUTOIMMUNE DISORDERS

00:32:30

- Means body starts making antibodies against itself

Systemic Lupus Erythematosus (SLE)

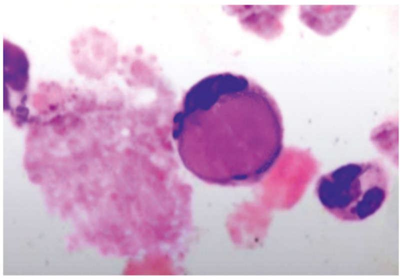
- Important clinical features
  - Malar rash- Butterfly-shaped rash
  - Discoid rash- Round rash
- Antibodies
  - Most sensitive- ANA (Antinuclear antibody)
  - Most specific- Anti-Smith antibody
  - Both sensitive and specific- Anti-dsDNA antibody
  - Neonatal lupus- Anti-Ro antibody
  - SLE with psychosis- Anti-ribosomal P antibody

Drug-induced SLE

- Mnemonic: SHIP-D
  - S = Sulfonamides
  - H = Hydralazine
  - I = Isoniazid
  - P = Procainamide
  - D = Dapsone
- Antibody- Anti-histone antibody

LE Cell

- ANA damages nuclear material
- Damaged nuclear material becomes a hematoxylin body
- This is engulfed by a neutrophil or macrophage
- This forms an LE cell
- LE cell = Neutrophil/macrophage that has engulfed a hematoxylin body



SJOGREN Syndrome

- Antibodies
  - Anti-SSA (Ro)- sensitive
  - Anti-SSB (La)- specific
- Glands involved
  - Lacrimal gland- Dry eye
  - Salivary gland- Dry mouth
- Diagnosis
  - Antibody testing
  - Lip biopsy
    - → Lips contain minor salivary glands
    - → Diagnostic cell seen = lymphocytes

Yourwish

Scleroderma

- Meaning- Sclero = stiff; Derma = skin
- Clinical features
    - Claw hand
    - Stone face- No facial expression
- Types
    - Limited scleroderma- Anti-centromere antibody
    - Diffuse scleroderma- Anti-topoisomerase antibody (AKA SCL-70)

Myositis

- Antibodies
    - Anti-Jo-1
        → Only the muscle affected
        → Polymyositis
    - Anti-MI-2
        → Muscle + skin affected
        → Dermatomyositis

Dermatomyositis Skin Findings

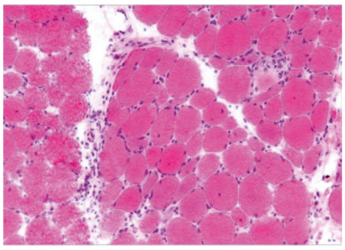
- Heliotrope rash
- Gottron papules
- V sign on the neck
- Shawl sign on the back
- Mechanic hands

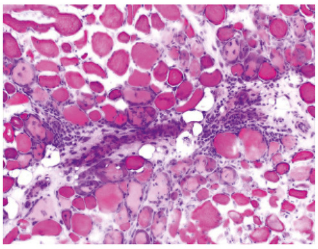
Microscopy

- Dermatomyositis
    - Everything occurs at the periphery
    - Perimysial inflammation
    - Perifascicular atrophy

- Polymyositis
    - Endomysial inflammation



Dermatomyositis

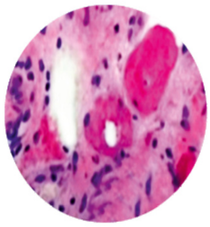


Polymyositis

Muscle Weakness

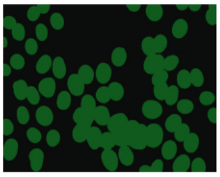
- Polymyositis
  - Proximal muscle weakness
- Dermatomyositis
  - Proximal muscle weakness

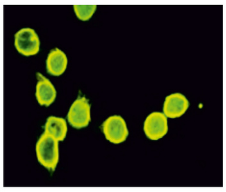
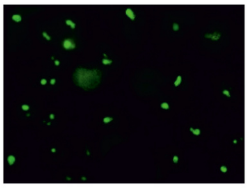
Inclusion Body Myositis

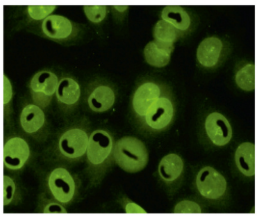


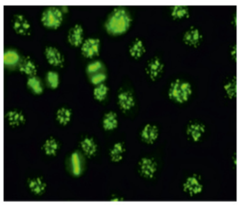
- Seen in old age
- Involves distal muscles
- Shows inclusions
- Inclusions are Congo red positive
- Therefore made of amyloid

Ana Patterns by Immunofluorescence

Homogeneous Pattern

	• Entire nucleus is uniformly green
	• Seen when antibodies are against
	  ○ Chromatin
	  ○ Histone
	  ○ Whole nucleus

Peripheral / RIM Pattern 	• Periphery is darker • Seen with Anti-dsDNA antibody
Nucleolar Pattern 	• Nucleolus becomes green • Seen when antibodies are against RNA

Speckled Pattern

	• Most common pattern
	• Can be seen in many diseases
	• Examples
	  ○ Anti-Smith
	  ○ Anti-Ro
	  ○ Anti-La
	• Not very disease-specific

Centromeric Pattern 	• Shows highlighted chromosomes/centromeres • Seen with Anti-centromere antibody • Associated with limited scleroderma

IMMUNODEFICIENCY

00:44:03

- MC cause- Malnutrition

Disorder	Key Defect/Genes	Affected Cells	Clinical Features	Important Associations
SCID	X-linked- γ subunit of cytokine Rc AR- ADA, JAK3, RAG1/2	T, B, NK	Recurrent infections, morbilliform rash	Most common: X-linked; AR: ADA deficiency
Bruton's Agammaglobulinemia	BTK gene	B cells	Recurrent bacterial infections (post-6 mths)	Boys, B-cell defect, no mature B cells
CVID	BAFF, ICOS genes	B & T cells	Recurrent infections, autoimmunity	Later onset than Bruton's
Bare Lymphocyte Syndrome	MHC II transcription factors	MHC II absent	Recurrent infections	"Naked" lymphocytes
DiGeorge Syndrome	22q11 deletion (TBX1)	T cells	Hypocalcemia, cardiac defects, abnormal facies	CATCH-22 mnemonic Cleft lip (conotruncal anomalies, Tetralogy of Fallot) Abnormal facies Thymic hypoplasia Cardiac abn Hypocalcemia (hypoparathyroidism) 22 = chromosome 22q1
Selective IgA Deficiency	Unknown (common)	IgA only	Mucosal infections, allergies	Give washed RBCs for transfusion
Hyper-IgM Syndrome	CD40/CD40L	Class switching	Recurrent infections, **Pneumocystis carinii**	High IgM, low other IgS
Hyper-IgE (Job Syndrome)	STAT3	Th17 cells	**F**acies (coarse), **A**bscess (cold Staph), **T**eeth (retained), **E**czema	Staphylococcal cold abscesses
Wiskott-Aldrich Syndrome	WASP gene XLR	T, B, platelets	Bleeding, infections, eczema; small-sized platelets, ↓ IgM, ↑ IgA/IgE, IgG normal	Classic small platelets disease prepladder

TRANSPLANTATION

00:54:25

Types of Grafts

Autograft

- Self-grafting
- Example: Skin from another part of the same person's body is used in burns

Isograft

- Graft between identical twins

Allograft

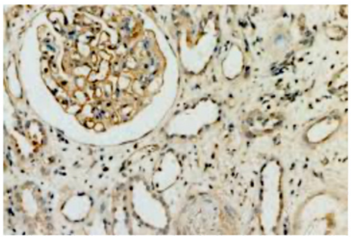
- Graft between the same species
- Example:
  - Human-to-human kidney transplant
  - Liver transplant
  - Bone marrow transplant

Xenograft

- Graft between different species
- Example: Heart valve from a pig

Transplant Rejection

FMGE 2018

Feature	Hyperacute Rejection	Acute Rejection	Chronic Rejection
Time	Within 48 hours (can occur on OT table)	Days to weeks	Weeks to months (most common type)
Mechanism	Preformed antibodies (Type II) • Multiple blood transfusions • Multiparity / multiple pregnancies	Antibody-mediated (Type II) + Cell-mediated (Type IV)	Cell-mediated (Type IV)
Antibody Source	Blood transfusions, multiparity	De novo or persistent antibodies	Chronic immune response
Key Pathology	Fibrinoid necrosis of vessels, coagulative necrosis	Humoral: C4d deposition (glomeruli, tubules, capillaries)-Rejection vasculitis  Cellular: Tubulitis, endothelitis	GOTI Changes: - Glomerular basement membrane duplication - Obliteration of vessels - Tubular atrophy - Interstitial fibrosis

Yourwish

AIIMS 2021

GVHD (Graft Versus Host Disease)

- Graft is accepted, but the graft attacks the recipient
- Graft is immunocompetent
- The recipient is immunocompromised

Types

- Acute GVHD = within 100 days
- Chronic GVHD = after 100 days

Organs Affected

1. Skin- Rash
2. Intestine- Diarrhea
3. Liver- Jaundice; Increased bilirubin

AMYLOIDOSIS

01:02:30

NEET PG 2024
FMGE 2025

- Misfolded protein
- Extracellular
- Eosinophilic/pink
- Has a starch-like property

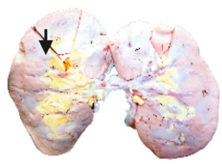
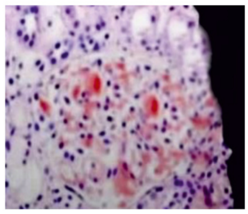
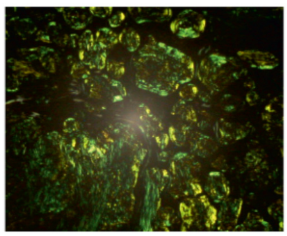
Types of Amyloid

Type	Associated Condition	Amyloid Protein	Key Notes
Primary	Multiple myeloma	AL (light chains)	Due to increased light chains
Secondary	Chronic inflammation (osteomyelitis, RCC, HL), IL-6 mediator	AA	Except for chronic bronchitis
Medullary Ca Thyroid	Calcitonin-producing tumor	ACal	Tumor marker = calcitonin
Alzheimer Disease	Neurodegenerative	Aβ (beta)	Brain plaques
Hemodialysis-associated	↑ β2-microglobulin	Aβ2	Dialysis-related
Diabetes Mellitus	Islet amyloid	AIAPP	Islet amyloid polypeptide
Systemic Senile	Age-related	ATTR (transthyretin)	↑ quantity of normal TTR
Familial Amyloid Polyneuropathy	Genetic	ATTR (mutant TTR)	TTR mutation

Organ Involvement in Amyloidosis

Organ	Deposition Site	Key Effects/Associations
Kidney	Mesangium (first site)	Most common organ affected: enlarged initially, shrinks later
Heart	Subendocardium	Most common in old age
Blood Vessels	Subendothelium	Vessel wall weakens → Periorbital purpura ("raccoon eyes")
Liver	Space of Disse	Hepatomegaly
Spleen	Red pulp → Lardaceous spleen White pulp → Sago spleen	Distinct gross patterns
Joints	Periarticular	Carpal tunnel syndrome (median nerve) Hemodialysis-related Aβ2 amyloid
Skin	Pinch purpura	Racoon eyes
GIT/Tongue	Submucosa	Macroglossia, organ enlargement

Diagnosis of Amyloid

Method	Key Finding	Notes
Gross	Waxy kidney	
Lugol Iodine	Mahogany brown color	Due to the starch-like property 
Congo Red (most important)	Light microscopy: Salmon pink/red Polarized microscopy: Apple green birefringence	Beta pleated sheet structure causes birefringence 
Thioflavin T	Fluorescence under UV light	Alternative stain
Electron Microscopy	Fibril diameter: 7.5–10 nm	Ultrastructural confirmation

X-ray Crystallography	Beta pleated sheet confirmation	Molecular structure
Scintigraphy	Detects the extent of amyloid deposits	Imaging modality
Preferred Sample	Abdominal fat aspiration (now preferred) Rectal biopsy (earlier)	Minimally invasive

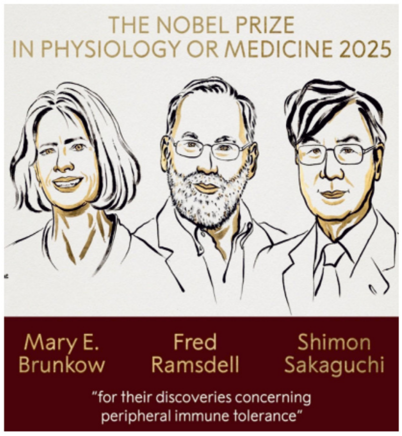
Bleeding in Amyloidosis

- Amyloid binds Factor X
- Factor X gets absorbed onto the amyloid
- Less free Factor X available for clotting
- So the patient develops bleeding

T Regulatory Cells

Markers

- CD4 positive
- CD25 positive



Gene

- FOXP3

Function

- Suppress immunity
- Prevent excessive immune activity
- Protect against self-damage

Ipex Syndrome

- Cause- FOXP3 gene defect
- T regulatory cells do not function properly
- Immune dysregulation
- Polyendocrinopathy
- Enteropathy
- X-linked

PYQs

01:13:20

Q. Which of the following is a marker of natural killer cells?

a. CD68

b. CD3

c. CD25

d. Cd94

Ans: d

Q. Which of the following cytokines is not involved in the Th1 response?
a. IFN gamma
b. IL-2
c. IL-12
d. IL-4

Ans: d

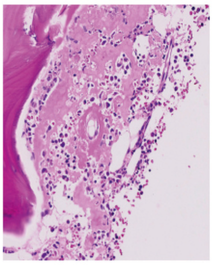
Q. A child is brought to the OPD by his parents with complaints of recurrent infections. On mediastinal imaging, the thymus gland was found to be absent. Based on further investigation, ADA levels are low. What is the most likely diagnosis?
a. Bruton's hypogammaglobulinemia
b. Bare lymphocyte syndrome
c. DiGeorge syndrome
d. Severe combined immunodeficiency (Autosomal recessive)

Ans: d

Q. Xenograft is:
a. Graft across species
b. Grafts from the same species
c. Graft from the same individual
d. Graft between genetically identical individuals

Ans: a

Q. A patient presented to the OPD with hepatosplenomegaly, and his bone marrow showed 22% of plasma cells. Biopsy reveals pinkish acellular material deposition. What is the most likely diagnosis?
a. Myxoid degeneration of the bone marrow
b. Amyloidosis
c. Plasma cell leukemia
d. Hemolytic anemia



Ans: b

Q. A 78-year-old male presents with fatigue, breathlessness, and palpitations. On examination, he has pedal oedema, with a pulse rate of 55 bpm, BP of 100/70 mmHg, and oxygen saturation of 94%. ECG is normal, and echocardiography reveals restrictive cardiomyopathy. A cardiac biopsy stained with Congo red shows apple-green birefringence under polarised light. What is the most likely diagnosis?
a. Heart failure
b. Cardiac amyloidosis
c. Hemosiderosis
d. Dystrophic calcification

Ans: b

Q. In a patient with Bare Lymphocyte Syndrome, graft-versus-host disease (GVHD) does not occur. Which of the following causes it?

a. Complement deficiency

b. Deficiency of CD4 T lymphocytes

c. MHC Class II deficiency in lymphocytes

d. MHC Class I deficiency in lymphocytes

Ans: c

Q. Which type of hypersensitivity reaction is a type 2 lepra reaction?

a. Type I hypersensitivity

b. Type II hypersensitivity

c. Type III hypersensitivity

d. Type IV hypersensitivity

Ans: c

Yourwish

2. IMMUNITY - ANTIGEN AND ANTIBODY

ANTIGEN

00:00:33

- Immunogenicity
  - The ability to generate or induce an immune response
- Antigenicity
  - The ability of an antigen to bind to an antibody
- All antigens with antigenicity might not show immunogenicity
- All antigens with immunogenicity will also show antigenicity

Hapten/ Pro-Antigen/ Incomplete Antigen

- Immunogenicity absent
- Antigenicity present
- Converted to a complete antigen by binding to a protein carrier

Heterophile Antigens

- Antigen → shares epitopes
- Antibody → cross-react
- Example:
  - Weil-Felix test (Rickettsia)

    → Patient blood (containing Rickettsia antibodies) is reacted with Proteus antigens (OX2, OX19, OXK).

    → Shared epitopes allow Rickettsia antibodies to react with Proteus
  - Paul Bunnell test

    → Used for Epstein-Barr Virus (EBV) / Infectious Mononucleosis

Super Antigens

- Regular Antigens
  - Taken up by Antigen Presenting Cells (APC)
  - Placed in the center of MHC and presented to the T-cell receptor (TCR)
  - Binding occurs at the center/junction
- Super Antigens
  - Avoids the central processing line
  - Show lateral binding to the side of the MHC and T-cell receptor
  - Consequences

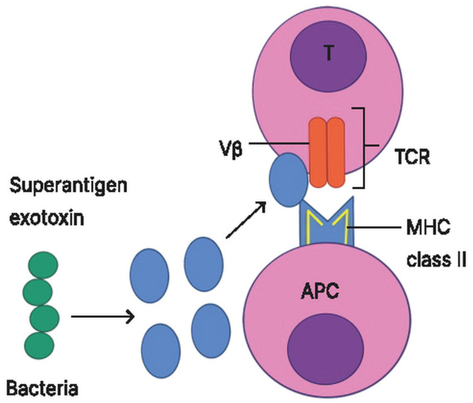
Induces >20% lymphocytes activation

↓

Leads to massive lymphokine release

↓

Toxic shock syndrome

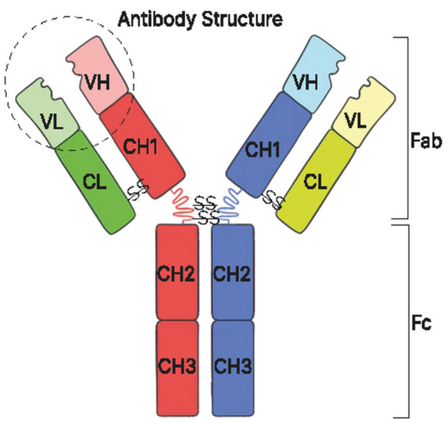


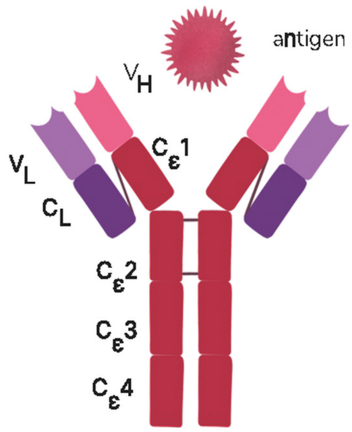
- Examples
  - Staphylococcus antigen
    → Toxic Shock Syndrome Toxin (TSST-1) → Enterotoxin F
    → Associated with a history of retained tampons
  - Streptococcal toxin (SPE- A&C)
  - Yersinia enterocolitica
  - Yersinia pseudotuberculosis
  - M. tuberculosis
  - EBV, CMV, Rabies
  - Malassezia furfur

ANTIBODY

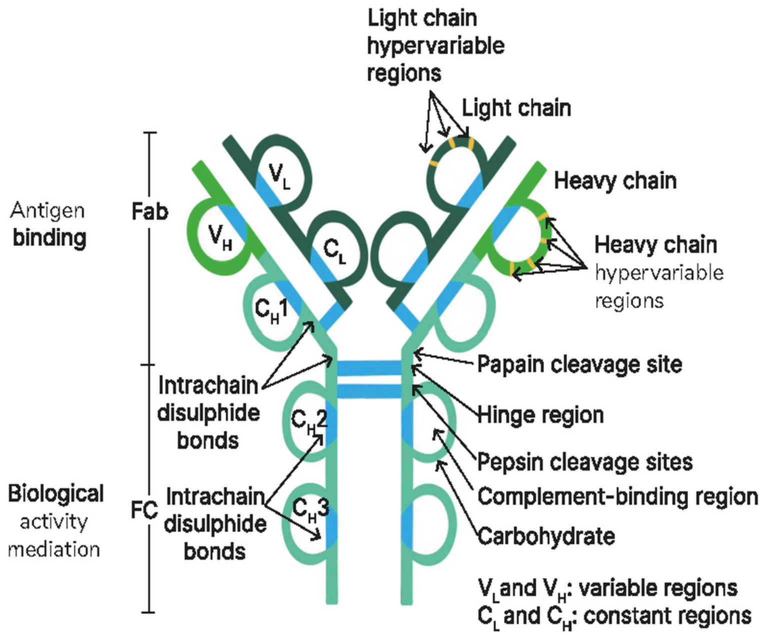
00:08:10

Antibody Structure

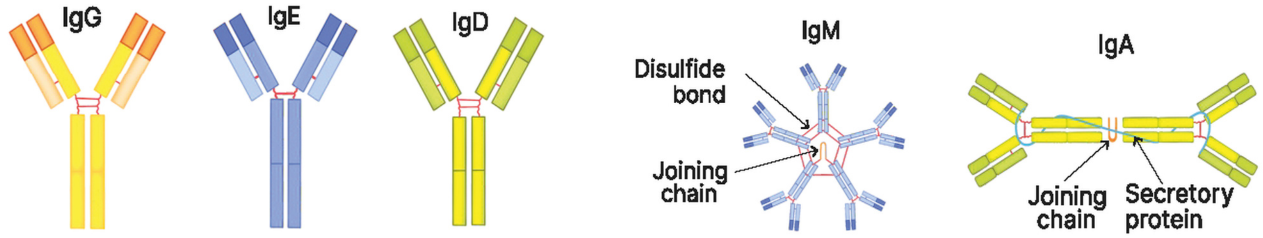




- Antibodies are categorized as IgG, IgA, IgM, IgD, and IgE
- Basic Structure
  - Heavy Chains (2)
  - Light Chains (2)
  - FAB Region: Antigen-binding fragment.
  - FC Region: Region where antigens do not bind.
  - Hinge Region: The point where the chains are connected
- Regions
  - Light Chain: 1 Constant region, 1 Variable region
  - Heavy Chain: 3 Constant regions, 1 Variable region
- Exceptions
  - IgM and IgE are heavier and have 4 Constant regions
- Antigen Binding Site
  - Binding occurs at the Variable region, specifically at the Hypervariable region / CDR (Complementarity Determining Region)

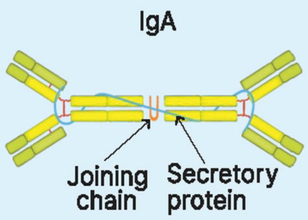


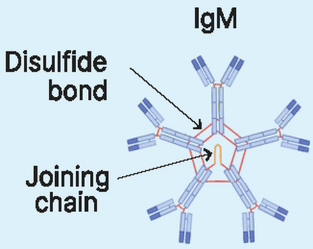
Immunoglobulins



- Concentration in blood: IgG > IgA > IgM > IgD > IgE
- Forms
  - Monomers: IgG, IgD, IgE
  - Dimer: IgA (usually)
  - Pentamer: IgM

IgG	• Highest concentration in the blood
	• Always exists as a monomer (Valency = 2)
	• The only antibody that crosses the placenta
	• Subtypes: G1, G2, G3, G4
	  ○ G2 has the least chance of crossing the placenta
	  ○ Opsonins: G1 and G3 are the best opsonins
	• IgG4: ↑ levels are associated with fibrosis (e.g., thyroid, abdominal)
	• Activates the Classical Pathway of the complement system (along with IgM)
	• Marker for chronic/long-term inflammation

IgA

	• Subclasses: A1, A2
	• Activates the Alternate Pathway
	• Forms:
	  ○ Solo/Monomer Ab (In blood)
	  ○ Dimeric Ab: Joined by a J-chain (joining chain) and a Secretory protein
	    → Mucosal Antibody: Present in respiratory and GI mucosa
	    → Secretory Antibody: Present in body secretions (E.g., Breast milk)

IgM

	• Pentameric, joined by a J-chain
	• "Millionaire antibody": Maximum Ag binding, maximum molecular weight
	• Valency:
	  ○ Theoretical = 10 Ag
	  ○ Practical = 5 to 6 Ag
	• Produced by the fetus by the 20th week of intrauterine life
	• Mostly intravascular distribution
	• Marker for acute/early inflammation
	• Activates the Classical Pathway

IgD	• Acts as a B-cell receptor (along with IgM) • Activates the Alternate Pathway
IgE	• Lowest concentration in the blood • Aka Homocytotropic or Reaginic antibody • ↑ In seasonal, drug, or food allergies • ↑ In parasitic infections (e.g., hookworm, roundworm).

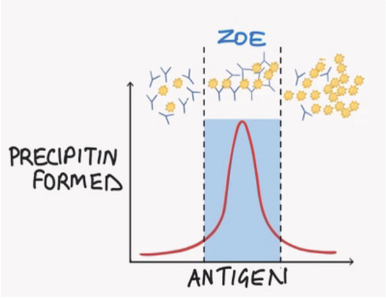
Yourwish

ANTIGEN-ANTIBODY REACTIONS

00:18:38

Marrack's Lattice Hypothesis

- Describes the formation of an immune complex
- Zone of Equivalence: Antigens and antibodies are in equal concentrations → Maximum immune complex/precipitate formation
- Prozone Phenomenon: Antibody excess → Proper immune complex does not form
- Postzone Phenomenon: Antigen excess → Proper immune complex does not form



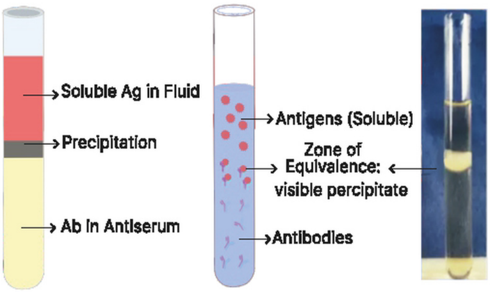
Types of Reactions

PRECIPITATION	AGGLUTINATION
• Occurs with Soluble Antigens	• Occurs with Particulate Antigens

Precipitation Reactions

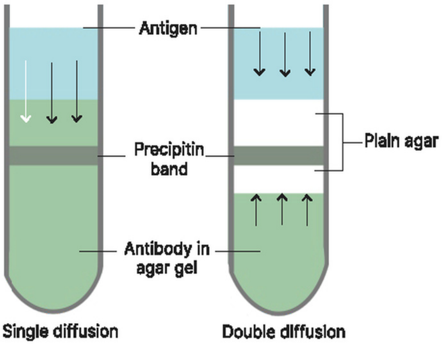
In Liquid Medium

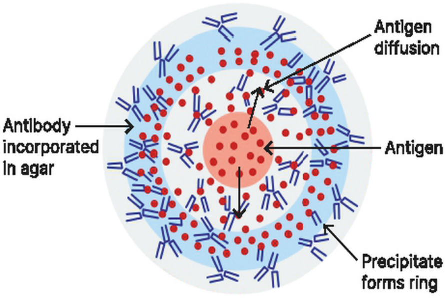
- Ring Test:
  - Reaction at the junction forms a ring
  - E.g., Lancefield grouping for Beta-hemolytic Streptococci, Ascoli's thermos ring precipitin test for Anthrax
- Flocculation Test:
  - Forms "floccules" (dots)
  - Used for Syphilis (Kahn test in a tube; VDRL test on a slide)



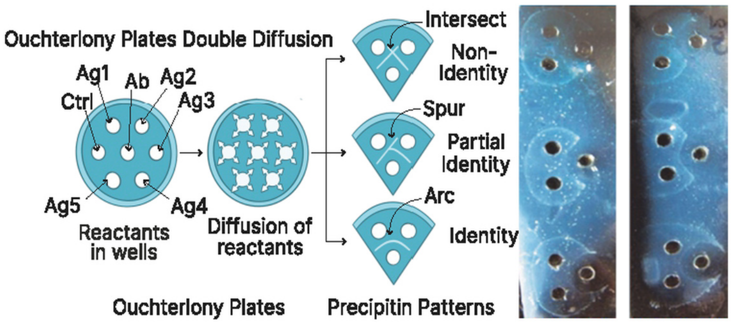
In Gel Medium

- 1D (Test Tube)
  - Single Diffusion: Only antigen moves (diffuses) → Oudin Test
  - Double Diffusion: Both antigen and antibody move → Oakley-Fulthorpe Test
- 2D (Slide):



Single Diffusion	 • Only antigen moves → Radial Immunodiffusion

Double Diffusion



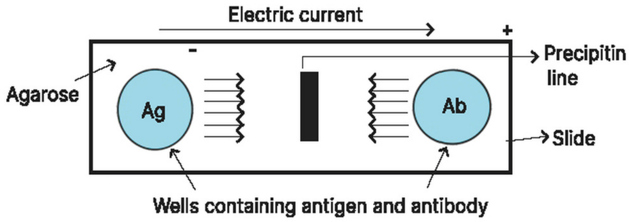
Ouchterlony Double Diffusion test

- Both move → Ouchterlony Test
- Interpretation of Ouchterlony (Double Diffusion in 2D):
  - Describes the relationship between different antigens reacting with a central antibody
  - Arc: Antigens are identical.
  - Cross/Intersect: Antigens are non-identical
  - Spur Formation: Antigens are partially identical
  - Eg: Elek's Gel Precipitation Test

Counterimmunoelectrophoresis

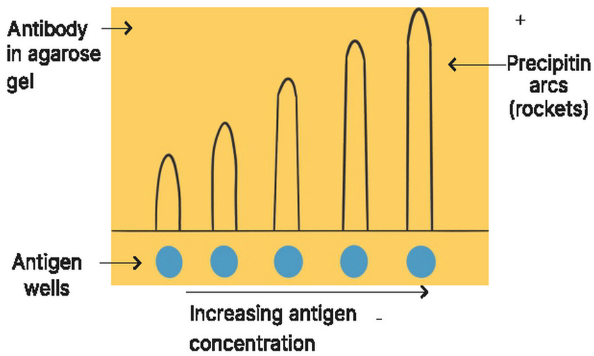
00:28:55

- Applying an electric current to make the antigen and antibody move toward each other faster
- Antigen and antibody diffusing same time



Rocket Electrophoresis

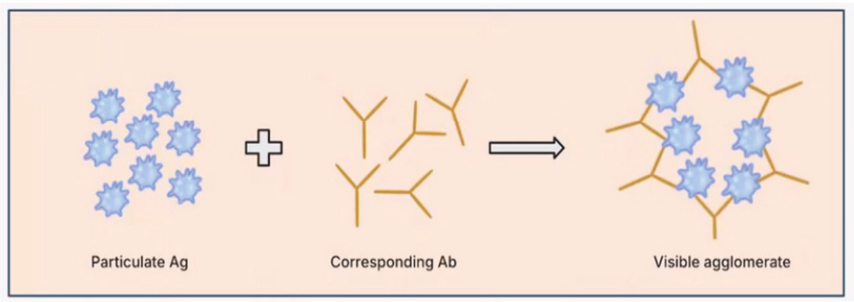
- Used for quantitative estimation of antigen



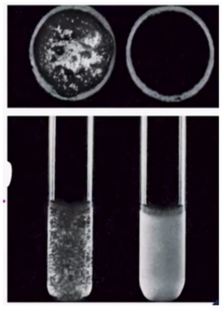
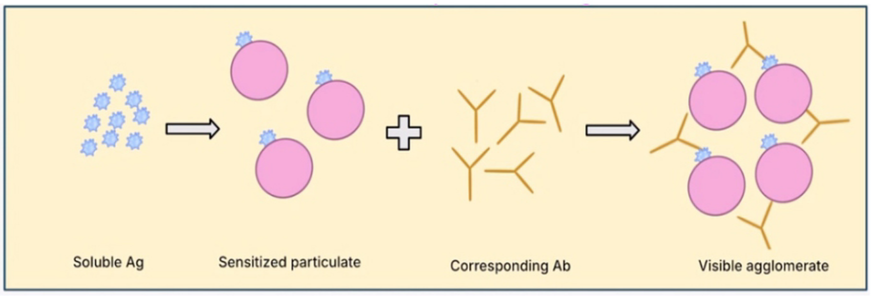
Agglutination Tests

- Better than precipitation reaction

DIRECT AGGLUTINATION



- Particulate antigen reacts directly with the antibody

<table>
<tr><td>DIRECT AGGLUTINATION</td><td>

○ Slide Agglutination: Used for blood grouping
○ Tube Agglutination
→ Widal Test (Typhoid)
→ Standard Agglutination Test (Brucella)
→ Cold Agglutination (Mycoplasma)
→ Weil-Felix Test (Rickettsia)
→ Paul-Bunnell Test (EBV)
→ Coombs Test (Autoimmune Hemolytic Anemia - AIHA)
Mnemonic
• CAT- MY: Cold Agglutination Test → Used for Mycoplasma
• SAT - Bi: Standard Agglutination Test → Used for Brucella
• MAT-Lii: Microscopic Agglutination Test → Used for Leptospira
</td></tr>
<tr><td>INDIRECT (PASSIVE) AGGLUTINATION</td><td>
• Uses carrier particles to detect reactions


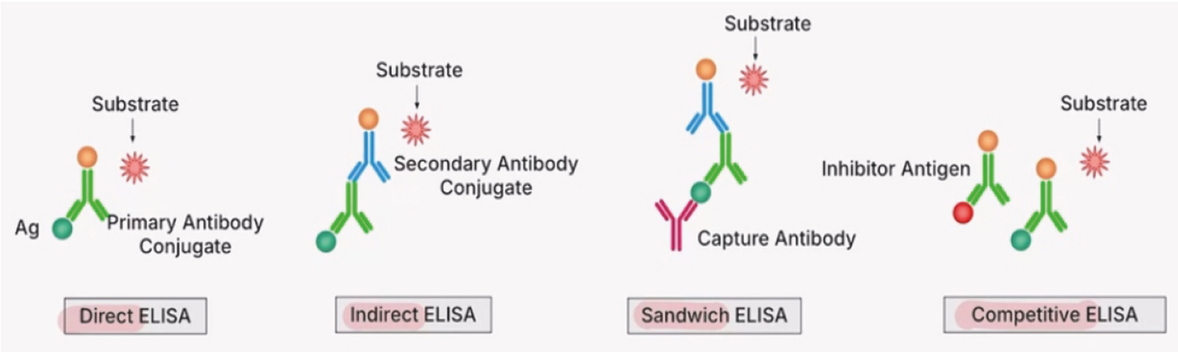
• Rule:
○ Agglutination requires a particulate antigen
○ Soluble antigens cannot undergo standard agglutination
○ Conversion: Soluble antigen is attached to a carrier particle (e.g., Latex or RBC)
○ Attached soluble antigen → Becomes particulate antigen
○ Particulate antigen + Antibody → Agglutination
• Example: Antistreptolysin O (ASO) titers for Streptococcal infection
</td></tr>
</table>

Elisa (Enzyme-Linked Immunosorbent Assay)

- ELISA plate contains 96 wells
- Components of ELISA
  - Enzyme: HRP (Horse Radish Peroxidase)
  - Substrate: H_2O_2 (Hydrogen Peroxide)
  - Chromogen (Coloring agent): Tetramethyl benzidine

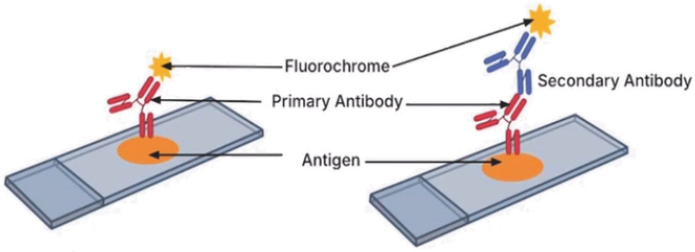
Types of Elisa

- Direct ELISA, Sandwich ELISA, Competitive ELISA
  - Used for detecting viral antigens (e.g., Hepatitis B surface antigen - HBsAg).
- Indirect ELISA
  - Used for detecting antibodies (e.g., Anti-HBs, COVID-19 antibodies, Hepatitis C antibodies)



Immunofluorescence

- Direct Immunofluorescence → Detects Antigen
- Indirect Immunofluorescence → Detects Antibody
- Dye used: FITC (Fluoro Iso thio cyanate).



Card Tests

- Applications
  - Malaria, Typhoid, COVID-19, HCV, HBV, HIV
  - UPT (Urine Pregnancy Test)
- Principle
  - Based on Immunochromatography
  - Center component: Nitrocellulose membrane (filter paper)
- Control Line ©:
  - Must always be positive/visible
  - Indicates the validity of the test and that the kit is not expired
- Test Line (T):
  - Positive Test Line → Disease present
  - Negative Test Line → Disease absent

PYQs

00:39:24

Q. Which of the following immunoglobulins shows the highest concentration in serum?

a. IgG

b. IgM

c. IgA

d. IgE

Yourwish

Ans: a) IgG

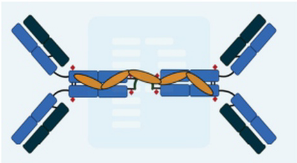
Q. Identify the following immunoglobulin.

a. IgA

b. IgG

c. IgD

d. IgM



Ans: a) IgA