PREP XI RR

STUDY NOTES

MICROBIOLOGY

9
VIDEOS

203
PAGES

PREMIUM STUDY MATERIAL

PREP XI RR

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1. GENERAL MICROBIOLOGY

BIG QUESTION 1: What is the historical significance of key discoveries in microbiology, and how have they shaped modern medical science?

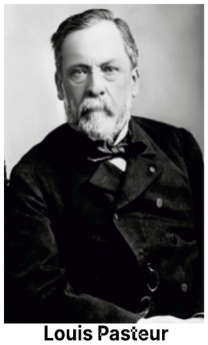
Broad answer: Louis Pasteur is known as the father of modern microbiology and developed vaccines for cholera, anthrax, and rabies. Robert Koch formulated Koch's postulates, discovered the causative agents of TB and cholera, and introduced solid media. Paul Ehrlich is the father of chemotherapy, developed the acid-fast stain, and standardized the toxin-antitoxin test. Their discoveries laid the foundation for germ theory, diagnostic microbiology, and vaccine development.

DETAILED QUESTIONS

Q1.1: Describe the major contributions of Louis Pasteur to microbiology.

Answer: Louis Pasteur, known as the Father of Modern Microbiology, founded the Pasteur Institute in Paris. His key contributions include:

- Development of pasteurization (milk preservation).
- Disproving spontaneous generation (abiogenesis).
- Introduction of liquid media for culture.
- Demonstrated the principle of fermentation.
- Discovery and use of the autoclave.
- Formulated the germ theory of disease.
- Developed vaccines for Cholera, Anthrax, and Rabies (Mnemonic: *CAR*).



Louis Pasteur

Q1.2: What are Koch's postulates and which organisms are exceptions?

Answer: Robert Koch established Koch's postulates to link specific microorganisms to specific diseases. They include:

1. The organism must be constantly associated with the disease.
2. It must be isolated in pure culture.
3. The pure culture must produce the disease when inoculated into a healthy host.
4. The same organism must be re-isolated from the diseased host.
5. (Modern addition): The infected host must produce antibodies against the organism.



Robert Koch

Exceptions to Koch's postulates (Mnemonic: LPG):

- L - Mycobacterium leprae (no culture, grows in armadillo).
- P - Treponema pallidum (syphilis, cannot be cultured).
- G - Neisseria gonorrhoeae (fastidious).

Other contributions of Robert Koch:

- Koch Bacilli (Tuberculosis)
- Cholera organism
- Solid culture media
- Aniline dye color
- Hanging drop motility - motility test

YOURWISH

Q1.3: What are the contributions of Paul Ehrlich?

Answer: Joseph Lister (used carbolic acid)

Q1.4: What are the contributions of Paul Ehrlich?



Paul Ehrlich

Answer:

- Ehrlichia organism
- Father of chemotherapy
- Toxin-antitoxin standardization (Nobel prize)
- Acid-fast stain/ Ziehl-Neelsen stain (modified of ZN stain)

Q1.5: Who first saw microorganisms under a microscope?

Answer:

- Anton von Leeuwenhoek (light microscope; called them "animalcules")
- Father of the light microscope (Unilocular)

Q1.6: What did Alexander Fleming discover?

Answer: Penicillin

Q1.7: Name the scientist behind the invention of PCR

Answer: Kary B. Mullis

Q1.8: Who invented the electron microscope?

Answer: Ernst Ruska

Q1.9: What are L-forms, and who discovered them?

Answer: Cell wall-deficient forms of bacteria; discovered by Kleinberger

Q1.10: Who received a Nobel Prize for CRISPR-Cas9?



Emmanuelle Charpentier



Jennifer A. Doudna

Answer: Emmanuelle Charpentier and Jennifer A. Doudna

Q1.11: Who discovered Transposons (jumping genes)?

Answer: Barbara Mcclintock

Q1.12: Who received a Nobel price for discovering HCV mechanism?



Michael Hougton



Harvey J. Alter



Charles M. Rice

Answer: Michael Hougton, Harvey J. Alter, Charles M. Rice

Q1.13: What is the contribution of Edward Jenner?

Answer:

- Developed the first vaccine- smallpox (Eradicated in 1980)

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Q1.14: What is the contribution of H C Gram to microbiology?

Answer: Gram staining

BIG QUESTION 2: What is the purpose of staining in microbiology, and how are different staining methods used to differentiate microorganisms?

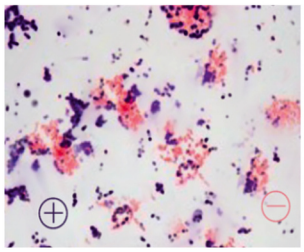
Broad answer: Differential staining is used in microbiology to distinguish between different types of microorganisms or their structures based on staining properties. The most common are Gram staining and Acid-Fast staining. Gram staining differentiates bacteria into Gram-positive (purple) and Gram-negative (pink/red) based on their cell wall properties. Acid-fast staining (Ziehl-Neelsen) differentiates acid-fast organisms like Mycobacterium. Other stains include Albert stain for C. diphtheriae, spore stains, and negative stains. These staining methods are crucial for diagnosis, treatment planning, and understanding microbial morphology.

DETAILED QUESTIONS

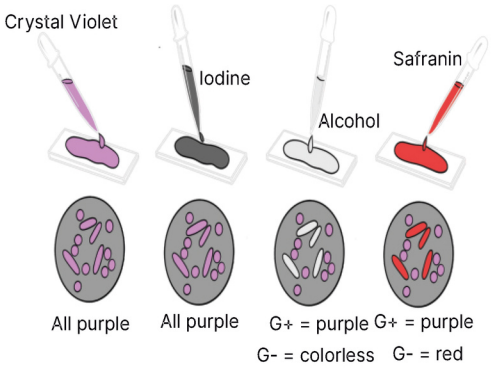
PYQ: AIIMS 2021

Q2.1: Describe gram staining technique

Answer:

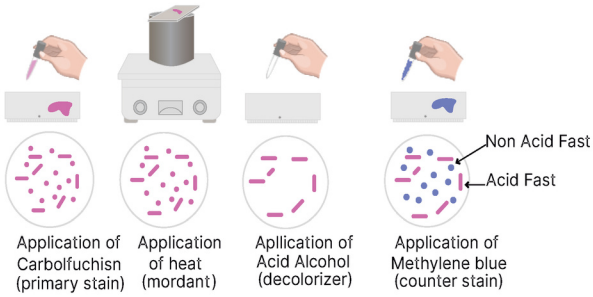


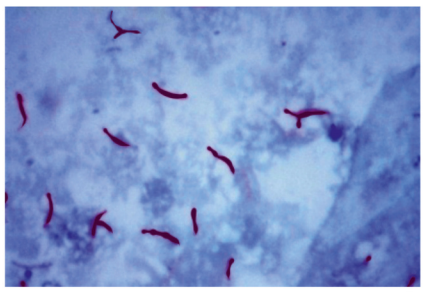
- Mnemonic: Come In And Stain
  - Crystal Violet (primary stain)
  - Iodine (mordant)
  - Alcohol/ Acetone (decolorizer) - Important step
  - Safranin (secondary stain)
- Results
  - Gram +ve: Purple
  - Gram -ve: Pinkish reddish color **(decolorized)**
- Poorly gram staining
  (Mnemonic- MRCS)
  - Mycoplasma
  - Rickettsia
  - Chlamydia
  - Spirochetes



Q2.2: What are the steps of Acid-Fast Stain (Ziehl-Neelsen Stain)?

Answer:





(Mnemonic: Class Has Asked Mnemonic)

- Carbol Fuschin (red) - Organism colored red
- Heating (mordant)
- Acid/ Acid-alcohol - Sulphuric acid (decolorized)
- Methylene Blue - Background color

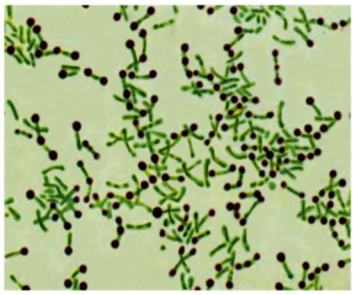
Q2.3: How are different acid-fast organisms differentiated based on the concentration of sulfuric acid (H_2SO_4) used in acid-fast staining?

Answer:

- Mycobacterium (Mnemonic: T20/25)
  - TB - 20-25% H_2SO_4
  - Lepra - 5% H_2SO_4 (Fite foracco stain)
  - Nocardia, Legionella - 1% H_2SO_4 (Modified ZN stain)
  - Spores, Head of sperm: 0.25 -0.5% H_2SO_4
- Acid Fast Organisms (Mnemonic-My Nose IS Cold Hot)
  - My - Mycobacteria
  - Nose - Nocardia, Legionella
  - IS - Isospora, Sperm
  - Cold - Cyclospora Cryptosporidium
  - Hot - Hooklet of hydatid, Taenia saginata egg
- If there is no heating, it is a cold Ziehl Neelsen Stain **(Kinyoun stain/Gabbet stain)**. It is used for Coccidian parasites
- Mordant: increased concentration of phenol

Q2.4: What are the components of Albert's stain?

Answer:



- Used for C diphtheria: (Mnemonic: TIM)
- Used for Volutin / Babes Ernst/Bipolar/Metachromatic Granules
- **Albert solution 1:**
  - Malachite green - Organism
  - Toluidine blue - Volutin granules
  - Glacial Acetic acid
- **Albert solution 2:** only has Iodine

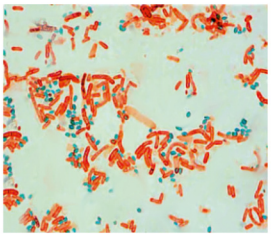
Q2.5: What are the Stains used for the detection of Volutin Granules?

Answer:

- (Mnemonic: PLAN)
  - Ponder's stain
  - Loeffler methylene blue (best stain)
  - Albert stain (TIM)
  - Neisser stain

Q2.6: What stains are used for the detection of spores?

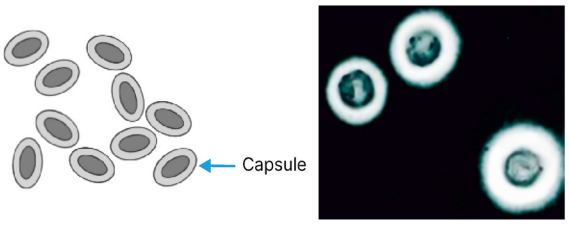
Answer:



- Spore stains (mnemonic: MS SPORE)
- Spore - Resting/ dormant form of bacteria
- ZN stain 0.25 -0.5% H_2SO_4
- Schaeffer and Fulton stain/ Modified Ashby stain
  - Malachite green - Spore
  - Safranin Red- organism

Q2.7: What are negative stains?

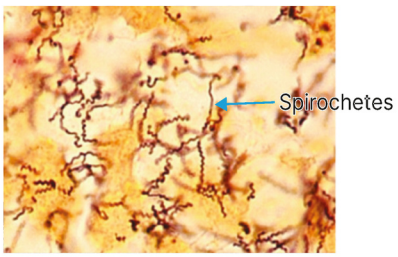
Answer:



- Negative stain (staining the background, so the sample is highlighted)
  - o India Ink
  - o Nigrosin
- **Use:** Cryptococcus (meningitis)

Q2.8: What are the uses of silver stains?

Answer:



- Silver stains- black color
- Fontana stain
- Levaditi's stain
- **Uses:** To visualize Flagella, Spirochetes.

Q2.9: What stain is used as flagellar stain?

Answer:

- Leifson and ryu's stain (Mordant tannic acid)
- **Uses:** Flagellar stain

Q2.10: What are the mordants used in various differential stains?

Answer:

Stains	Mordant
Gram Stain	I_2
ZN Stain	Heat
Kinyoun Stain	Phenol
Leifson & Ryu Stain	Tannic Acid

BIG QUESTION 3: Describe different types of microscopes used in microbiology

Broad answer: Several microscopes are used in microbiology based on the nature of observation:

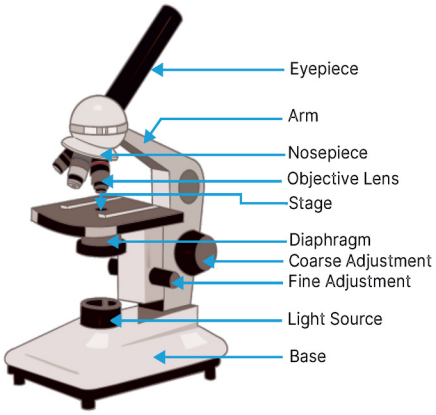
1. Light Microscope uses transmitted light and offers up to 1000x magnification, with lenses: scanner (4x), low (10x), high (40x), and oil immersion (100x).
2. Dark Field Microscope uses reflected light and is ideal for thin, motile structures like spirochetes and flagella.
3. Fluorescence Microscope uses UV light, with fluorochromes (e.g., auramine for TB, acridine orange for malaria) and a dichroic mirror.
4. Phase Contrast Microscope detects refractive index differences, useful for internal cell structures like hairy cells.
5. Electron Microscope (by Ernst Ruska) uses electrons in a vacuum, offers high resolution, with SEM for surface and TEM for internal views.
6. Interference Contrast Microscope highlights organelles and helps measure proteins, lipids, nucleic acids.

DETAILED QUESTIONS

Q3.1: What are the features of light microscope?

PYQ: AIIMS 2018

Answer:



Light Microscope

- Light source - Transmitted light for microscopes
- Two lenses
  - o Eyepiece lens - 10X
  - o Objective lens
    - → Scanner - 4X
    - → Low Power - 10X
    - → High Power - 40X
    - → Oil Immersion - 100X
- Total magnification = Eyepiece x objective To Remember
- Max magnification offered by light microscope is 1000X

PYQ: NEET PG 2021 PYQ: FMGE 2021

Q3.2: What are the features and uses of dark field microscope?

Answer:



- Light source : reflected light
- Used for thin structures
  - o Flagella
  - o Spirochetes - Spiral structures

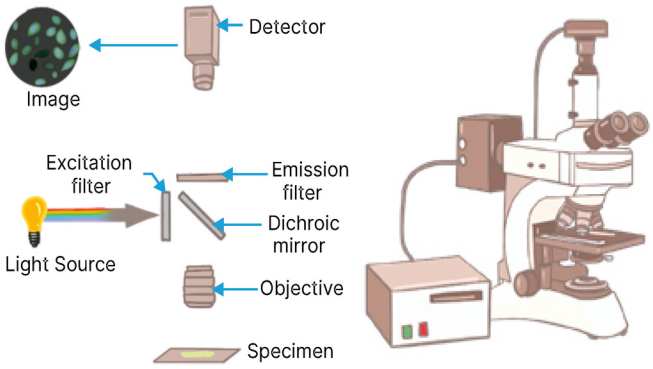
Q3.3: What are the uses of Interference Contrast Microscope?

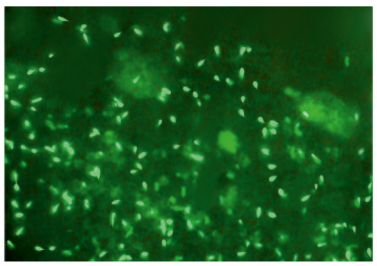
Answer:

- Reveals cells organelles
- Measurements of chemical constituents of cells, such as:
  - o Lipids
  - o Protein
  - o Nucleic acid

Q3.4: Describe the principle and features of fluorescent microscope

Answer:





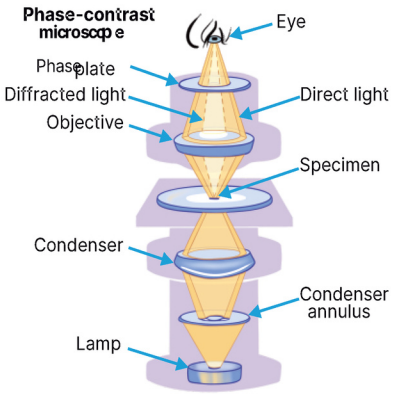
- Source of light: Ultraviolet light
- Mirror: **Dichroic mirror**
- Principle
  - o Light of a shorter wavelength will be converted to light of a longer wavelength light.

- **Different dyes**
  - TB - Auramine and Rhodamine
  - Malaria - Acridine Orange
  - Fungus - Calcofluor White
  - Flow Cytometry - FITC (Fluoro isothiocyanate)
- **Autofluorescence micro-organisms** (shine on their own)
  - Cyclospora
  - Isospora
  - Formalin
  - NADPH

PYQ: AIIMS 2022

Q3.5: Describe uses, principle and parts of Phase contrast microscope

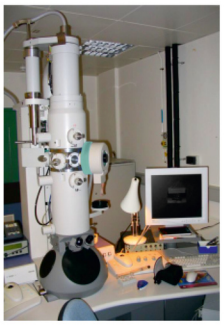
Answer:



- Use: Internal details of cells
- Principle
  - Differences in refractive indices will be shown in different phases
- Parts
  - Annular diaphragm in front of the condenser - Bottom
  - Annular phase plate - Top
- Hairy cells in hairy cell leukemia is seen on phase contrast microscope.

Q3.6: What are the salient features and types of electron microscopes?

Answer:



- Invented by Ernst Ruska
- No light is used
- Source: A beam of an electron is used (electron is enclosed)
- Medium: Vacuum

Types of electron microscope

Scanning Electron Microscope (SEM)	Features	Transmission Electron Microscope (TEM)
Scattered electrons	**Principle**	**Transmitted electrons**
3D	**Dimensional**	2D
More samples viewed in less time	**View and Time**	Less samples viewed in the same time
Surface details seen	**Details**	Internal Details

Q3.7: What are the differences between light microscope and electron microscope?

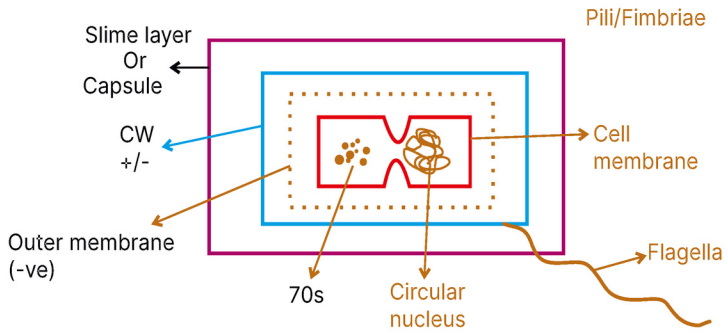
Answer:

Electron Microscope	Features	Light Microscope
2-2.5% Glutaraldehyde	**Fixation**	10% Neutral Buffered Formalin(NBF)
Resin	**Embedding**	Paraffin wax
Copper metal slides	**Slide**	Glass slides

Electron	**Source**	Transmitted light
Vacuum	**Medium**	Air
Higher	**Resolution**	Lower

BIG QUESTION 4: What is the anatomy of a bacterial cell and how does it relate to its structure and function?

Broad answer: Bacteria possess distinct structural features such as a rigid cell wall, nucleoid, ribosomes, and surface appendages that support their survival and interaction with the environment. These structures facilitate vital physiological processes like metabolism, energy production, and reproduction. The close link between form and function enables bacteria to adapt, grow, and cause disease in diverse conditions.



DETAILED QUESTIONS

Q4.1: Describe capsule in brief and enlist capsulated organisms

Answer:

Capsule

- Capsule - tough and demarcated
- Slime layer - loose

Capsulated organisms (Mnemonic: Pretty NIce Capsule)

- Streptococcus Pneumonia
- Klebsiella Pneumoniae
- Bordetella Pertussis
- Vibrio Parahaemolyticus
- Clostridium Perfringens
- Yersinia Pestis
- Neisseria meningococcus
- Hemophilus Influenza
- Cryptococcus (fungus)
- Staphylococcus Aureus
- Bacillus Anthracis

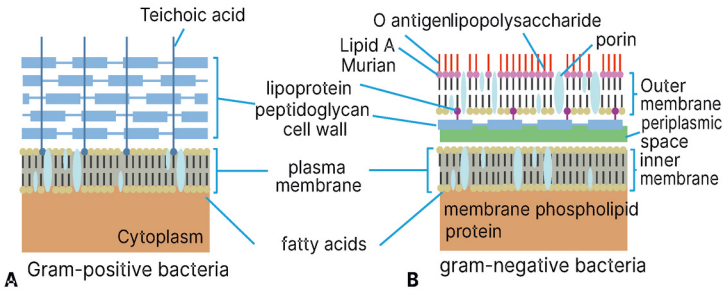
- All capsules are made of polysaccharides.
- Except
  - Yersinia pestis - F1 peptide
  - Bacillus anthracis - polypeptide
- S. aureus has microcapsule

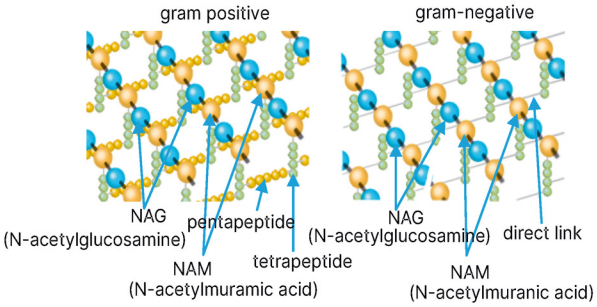
Q4.2: What are the differences between Gram-positive and Gram-negative bacterial cell walls?

Answer:

Gram positive Image A (gram +ve) **Mnemonic: PPPT** • P - Positive • P- Peptidoglycans • P - Pentapeptide cross bridge • T- Teichoic acid	**Features**	**Gram negative** Image B (gram -ve)
2-5 %	**Lipid content**	15-50%
Peptidoglycans++ Lipoproteins	**Composition**	Lipopolysaccharide ++ Mnemonic-OPA • O - O antigen • P - polysaccharide • A - lipid - A
Pentapeptide cross bridge present	**NAM NAG**	Pentapeptide bridge absent
+	**Teichoic acid**	-
-	**Periplasmic space,** **Porins,** **Outer membrane**	+

NOTE: Periplasmic space has , which is a feature of spirochetes





Q 4.3: Which bacteria has both slime layer and capsule ?

Answer:

- Streptococcus salivaris

Q4.4: What is the structure of the bacterial cell membrane?

Answer:

- The bacterial cell membrane is a phospholipid bilayer that functions as a selective barrier and site for various metabolic processes.
- Mesosomes are invaginations of the cell membrane, more prominent in Gram-positive bacteria, and are thought to function in cell respiration, DNA replication, and cell wall synthesis.
- These are also called chondroids.
  - o They are important in theoretical microbiology as the respiratory units of prokaryotes.

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Q4.5: What ribosome is present in a bacterial cell?

Answer: 70S ribosome

Q4.6: What are the features of bacterial nucleus?

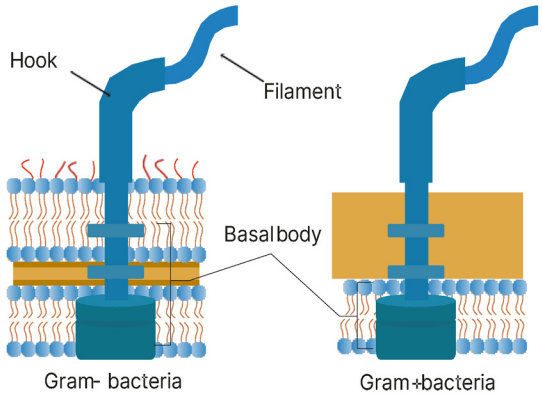
Answer:

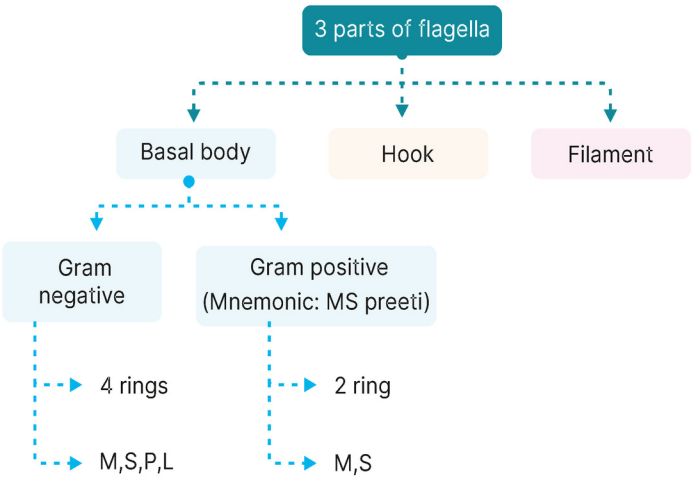
- Single circular
- Double stranded DNA

Q4.7: What is the morphology of flagella?

Answer:

- Use: Locomotion
- Flagella antigen - H antigen
  - o Widal test for typhoid
    - → O antigen - cell wall
    - → H antigen - flagella



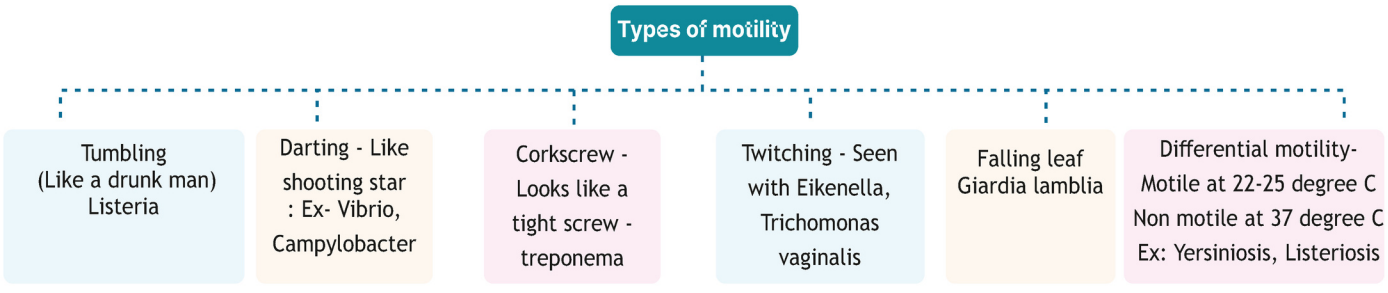


Q4.8: How are flagella classified based on their location?

Answer:

Monotrichous	Amphitrichous	Lophotrichous	Peritrichous
• One flagella on side • **Ex:** Vibrio, Pseudomonas	• Flagella on either side	• **Entire tuft** of flagella on one side • **Ex:** Helicobacter	• Flagella all around the periphery • **Ex:** (Mnemonic: PERitrichous) o **PR**- Proteus o **E** - E.coli o Listeria

Q4.9: What are the types of bacterial motility?



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Q4.10: Which motile bacteria show characteristic spreading or swarming growth on agar media, and how can they be identified in the lab?

Answer:

known as swarming

- Organisms:
- Proteus
- Vibrio parahaemolyticus, Vibrio alginolyticus
- Clostridium tetani, Bacillus Cereus
- Serratia

Q4.11: What are fimbriae or pili used for?

Answer: Adhesion to surfaces or host tissues

Q4.12: How are fimbriae detected?

Answer:

- Hemagglutination test (e.g., E. coli, Klebsiella)
- Surface pellicle formation

Q4.13: What is the use of Type IV pili in Neisseria and pseudomonas?

Answer: Locomotion

Q4.14: How are bacteria classified based on their atmospheric requirements?

Answer:

O_2- Oxygen

- Aerobic - Need O_2
- Anaerobic - Not needed O_2
- **Obligate aerobes** (Must Let Nagging Pets Breathe)
  - MTB
  - Legionella
  - Nocardia
  - Pseudomonas
  - Bacillus
  - Brucella
  - Bordetella
- **Obligate Anaerobes** (Choked By Air)
  - Clostridium
  - Bacteroides
  - Actinomyces
- **Facultative anaerobes**
  - Staphylococcus
  - Streptococcus
  - Enterobacteriaceae
  - Haemophilus
  - Vibrio
- **Microaerophilic** (5% of oxygen needed)
  - **Ex:** Helicobacter and campylobacter

CO_2- Carbon dioxide

- Capnophilic
- **Ex:** Campylobacter
- **pH:** Usually 7.2 to 7.6
- **Except**
  - H.pylori - Need acidic pH
  - Proteus - Need alkaline pH

Q4.15: How are bacteria classified based on their thermal growth conditions?

Answer:

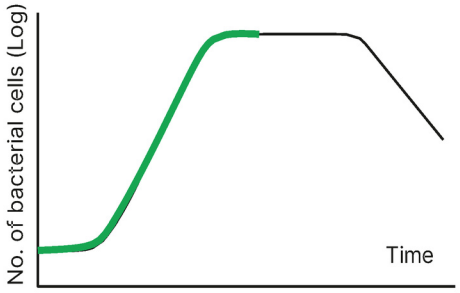
Temperature

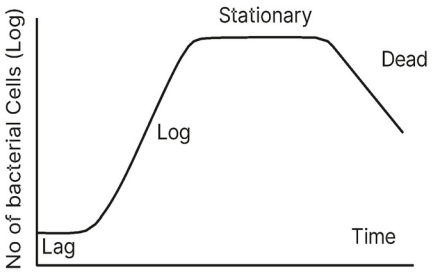
Psychrophile	Mesophile	Thermophile
• <20°C • **Grow better at low temperatures**	20-40°C	• 55-80°C • **Ex: Bacillus geothermophilus**

Q4.16: Describe the phases of the bacterial growth curve and the key features of each phase.

Answer:

1. Lag Phase - No cell division; bacteria increase in size and synthesize enzymes and metabolites. Maximum cell size is reached at the end of this phase.
2. Log (Exponential) Phase - Rapid cell division occurs. Cells are smaller in size but show maximum metabolic activity. This is the ideal phase for antibiotic susceptibility testing.
3. Stationary Phase - Nutrients deplete; growth rate equals death rate. Features include sporulation, toxin and antibiotic production, and bacteriocin release. (Mnemonic: S-T-A-B)
4. Decline/Death Phase - Death of bacteria due to toxic accumulation and lack of nutrients. Involution forms may be seen.





BIG QUESTION 5: What are the methods of gene transfer in bacteria, and what is their importance?

Broad answer: Bacteria transfer genetic material through three main methods: transformation, transduction, and conjugation. In transformation, bacteria take up free DNA from their environment, especially during the log phase. Transduction involves DNA transfer via bacteriophages, and it's the most common mechanism of resistance in *Staphylococcus aureus*. Conjugation requires direct contact through sex pili and is the most common overall mode of resistance. These processes contribute to genetic variation, virulence, and antibiotic resistance in bacteria.

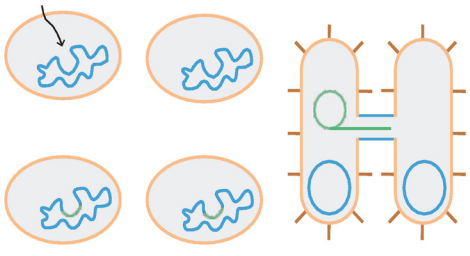
DETAILED QUESTIONS

Q5.1: What is bacterial transformation, and what is its significance in genetic exchange?

Answer:

Transformation:

- Involves uptake of free DNA fragments from the environment.
- Requires competence factors and occurs during log phase.
- Example: Streptococcus pneumoniae.
- Uptake of soluble DNA fragments by bacteria
  - o Through cell wall



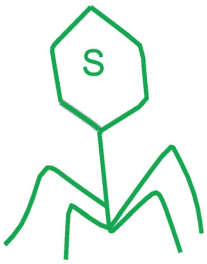
(a) Transformation (b) Transduction (c) Conjugate

- During log phase (division)
- Required competence factor

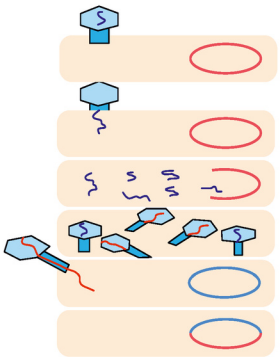
Q5.2: What is bacterial transduction, and how does it contribute to gene transfer?

Answer:

Transduction:

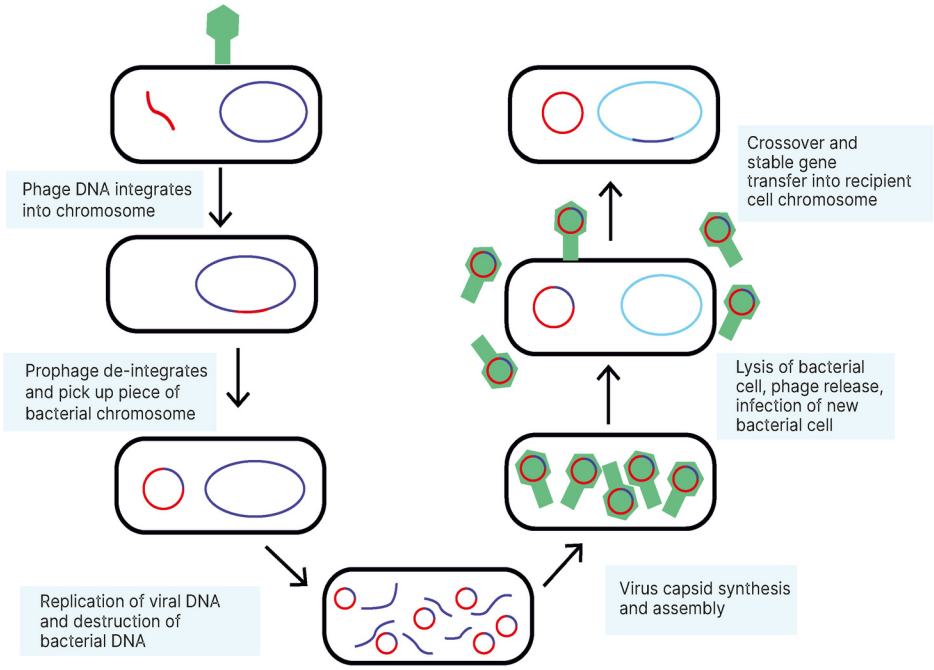


Structure of bacteriophage



Generalized Transduction

- MC mode of drug resistance in S.aureus
- DNA transfer occurs via a bacteriophage (DNA virus).
- Tadpole shape/ circular/ filamentous.
- Two types:
  a) Generalized - random DNA packaged into phage.
  b) Specialized - specific genes transferred after a lysogenic cycle.



Q5.3: What is bacterial conjugation, and what role does it play in gene transfer?

Answer:

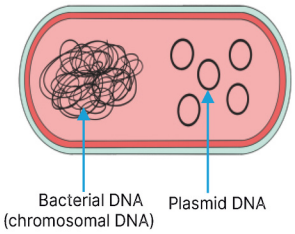
Conjugation:

- Involves direct contact via sex pili between F^+ (male) and F^- (female) cells.
- Transfers plasmid DNA or chromosomal DNA via Hfr cells.
- Most common method for spreading multi-drug resistance.
- Except - S.aureus - Transduction → conjugation
- Except - Strep.Pneumoniae - Transformation

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Plasmids

- **Plasmid:** Extrachromosomal circular dsDNA
- **Fertility(F) :** Code for fertility factor (male or female)
  - o Male - Present (F)
  - o Female - Absent (F)
- **Resistance(R):** Code for resistance

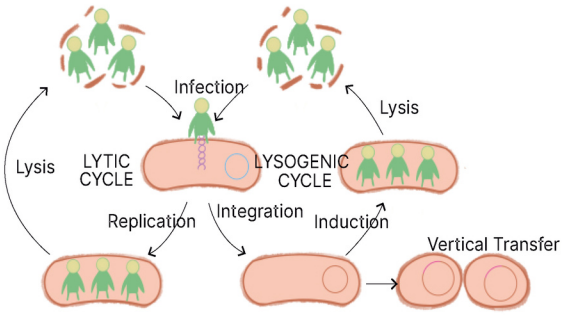


Q5.4: Describe bacteriophage cycle

Answer:

Two cycles

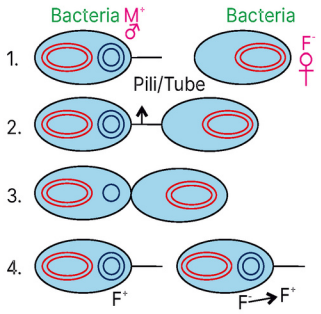
- Lytic: Lysis of infected bacteria
  - o Breakdown bacterial cell wall
- Lysogenic: Bacteriophage DNA combine with donor DNA
  - o Vertical transfer to daughter cells



Bacterial Toxins Coded by Lysogenic Conversion

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

Q5.5: Explain the process of conjugation between F^+ and F^- bacteria.

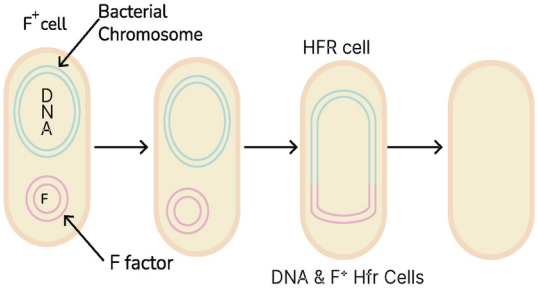


Answer:

- In conjugation, an F^+ bacterium (male) possesses the F-plasmid, which encodes genes for pilus formation.
- The sex pilus attaches to an F^- bacterium (female), and a conjugation bridge forms.
- The F^+ cell replicates the F-plasmid and transfers a single-stranded copy to the F^- cell.
- The recipient synthesizes the complementary strand, becoming F^+ itself.
- No chromosomal DNA is transferred in basic $F^+ \rightarrow F^-$ conjugation.
- This transfer helps spread plasmid-encoded traits, such as fertility or drug resistance.

Q5.6: What is an Hfr cell and how does it differ from a regular F^+ cell in conjugation?

Answer:

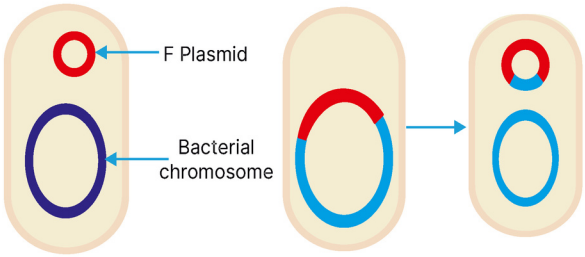


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- An Hfr (High Frequency Recombinant) cell forms when the F-plasmid integrates into the bacterial chromosome.
- During conjugation with an F^- cell, the Hfr attempts to transfer chromosomal genes beginning from the insertion point.
- However, due to the fragility of the conjugation bridge, full plasmid transfer often fails, and the recipient remains F^- but may incorporate new chromosomal genes, promoting recombination (Hfr with F^- = rF^-).
- This process is used to map bacterial genes and understand horizontal gene transfer.

Q5.7: What is F' (F prime) plasmid and what is sexduction?

Answer:



- An F' plasmid is formed when the integrated F-plasmid (from an Hfr cell) excises improperly, taking along some bacterial chromosomal DNA with it.
- This recombinant plasmid can now transfer both fertility genes and donor DNA to F^- bacteria.
- This process is called sexduction.
- When F' conjugates with an F^- cell, the recipient becomes F' and gains additional genes, often conferring new traits or functions.
- This is significant in gene mapping and understanding genetic exchange.

Q5.8: Compare and summarize outcomes of various conjugation scenarios.

Answer:

Conjugation Type	Donor	Recipient	Outcome
$F^+ \times F^-$	F^+ (free plasmid)	F^-	Both become **F^+**
Hfr × F^-	Hfr (F + chrom.)	F^-	No F^+ conversion; partial chromosomal gene transfer (F^-)
F' × F^-	F' (F + donor DNA)	F^-	Both become **F'**

Q5.9: Describe transferable and mutational drug resistance

Answer:

Transferable Drug Resistance

R plasmid

- Resistance = Resistance Transfer Factor (RTF) + Resistance determinants
- More dangerous
- Difficult to treat

Mutational Drug Resistance

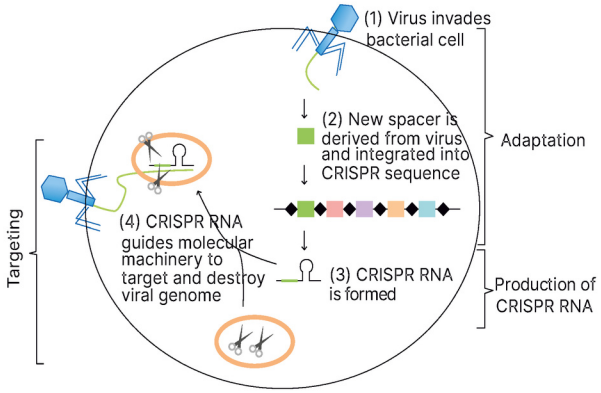
- Due to single mutation

- Single drug resistance
- Easier to treat
- Ex: Rifampicin resistance in TB is due to RPOB gene

Q5.10: What is CRISPR-Cas9? How is it used in genome editing?

Answer:

- Genome editing
- Trick
  - Cas9 - Scissors
  - C - Clustered
  - R - Regularly
  - I - Interspaced : viral memories
  - S - Short
  - P - Palindromic
  - R - Repeats



- Virus is killed and is saved in memory (interspersed - spaces) - Viral elemental memory Sterilization Methods
- CRISPR-Cas9 is a bacterial defense system against viruses
- **FELUDA test,** based on CRISPR-Cas9 for COVID

BIG QUESTION 6: What are the various physical and chemical methods of sterilization and how do they work?

Broad answer: Sterilization is the process of completely eliminating all forms of microbial life, including spores, while disinfection refers to reducing or eliminating pathogenic microorganisms on surfaces or objects, excluding spores. These methods are essential in microbiology and healthcare to prevent contamination and infection.

DETAILED QUESTIONS

Q6.1: What are the main types of sterilization?

Answer:

- Physical methods
  - Heat
  - Filtration
  - Radiation
- Chemicals methods

Q6.2: What are the differences between dry heat vs moist heat sterilization?

Answer:

Dry heat	Moist heat

• Hot air oven
• Incinerator
• Mechanism (C O D E)
  o Charring
  o Oxidative damage
  o Denaturation of proteins
  o Elevation of Electrolytes
	• Vapors
	• Most effective
	• Moist heat is considered better
	  o Steam is created and acts as latent heat

Q6.3: What are the features and uses of a hot air oven?

Answer:



- **Dry Heat**
  - Hot Air Oven: 160°C for 2 hrs
    - → Used for: Glassware, cotton swabs, oily substances, Dusting powder, Greasy material, Liquid paraffin.
    - → Biological control: Bacillus subtilis, B. atrophaeus, C. tetani
    - → Chemical control: Browne's tube (green spot indicates completion)



Q6.4: What is incineration?

Answer:

- Incineration is a type of dry heat sterilization
  - Dual chamber: 700-800°C and 1000-1100°C
  - Used for: Hospital and anatomical waste

Q6.5: What are the features and uses of moist heat sterilization?

Answer:

Below (mnemonic: IPL)	At 100°C (mnemonic: BAT)	Above
Pasteurization (Milk) • Holder method: 63°c × 30 mins • Flash method: 72°c × 20 secs • Cool to <13°c • Flash method is better as it kills Coxiella burnetii	Boiling • At **100°** for 15 min • Does not kill spores	Autoclave • 121°c x 15 min x 15 psi • For prions o 134 c x 1.5 hrs • **Control** o Bacillus Stearo Thermophilus
Inspissation • 80 degree c x 20-30mins x 3 consecutive days • Used for: I L L • LJ media for TB • LSS	Tyndallization • **100°c** x 20min x 3 days • Kill spores	
Water bath • 60°c x 60min • Bacterial vaccines are heat inactivated.		

Q6.6: What are the uses of autoclave?

Answer:



Pressure cooker type



Horizontal autoclave



Vertical Autoclave



Large automatic hospital autoclave



Common laboratory autoclave

- Used to sterilize:
  - Instruments
  - Aprons
  - Sutures, except Catgut sutures (heat sensitive)
  - Media, except LJ, LSS
    - → Because LJ and LSS are in <100°C
    - → Sputum
      - Prior to discard it is autoclaved

Q 6.7: Describe filtration as a method of sterilization

Answer:

- Filtration removes microbes from heat-sensitive liquids using physical barriers.
- Common filter: **Seitz filter** (made of asbestos; pore size 0.22 µm).
- Used for sterilizing:
  - Vaccines
  - Antibiotics
  - Toxins
  - Serum
  - Sugar solutions
- Air purifiers:
  - HEPA (High Efficiency Particulate Air) filters
  - ULPA (Ultra Low Particulate Air) filters
- Biological control: Brevundimonas diminuta, Serratia

Note: Asbestos is carcinogenic

Q6.8: Differentiate between ionizing and non- ionizing radiation used in sterilization

Answer:

Ionizing Radiation	Non-ionizing radiation (Hot radiation)
• Examples o X rays o Gamma rays o Cosmic rays • Cold radiation o Does not increase the temp of surface • **High penetrating power** • Sporicidal • Uses o **Catgut sutures** o **Grafts**	• Examples o UV rays o Infrared rays → OT Fumigation → Biosafety cabinet • Microbiologist works • Low penetrating power • Bactericidal (not sporicidal) **Control:** • Bacillus Pumilus o P = R

Q6.9: What are the various methods of chemical sterilization?

Answer:

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1. Alcohols

- Ethyl alcohols (70%): Spirit swabs
- Isopropyl Alcohol: (70-80%)
  - o **Stethoscope**
  - o Thermometer

2. Formaldehyde

- Gas- OT fumigation
- Formalin (liquid) - All human specimens stored
- **Duckering** - killing bacillus anthracis spores from animal wool
  - o Process where animal wool is treated with 2% formaldehyde

3. Glutaraldehyde

- Glutaraldehyde
  - o **CIDEX**
- Activated by alkalinisation- active for 14 days
  - o Bronchoscope
  - o Laryngoscope
  - o Endoscope
  - o Except: **Arthroscope and urethroscope sterilized by plasma sterilization**

4. Phenol

- Antiseptics
  - o Phenol (5%)
  - o Cresol (1-3%)
  - o Lysol (2-5%)
  - o Modified phenol
    - → **Chlorhexidine + Cetrimide = Savlon (Old name for savlon: Hibitane and Citavlon)**
    - → Chloroxylen**ol** = **Dettol**

5. Halogens

a. Iodine

- Skin antiseptic
- Betadine (povidone iodine)
- Tincture iodine (2% iodine) for skin antiseptic

b. Chlorine

- **1% sodium hypochlorite** for blood spill

6. Plasma Sterilization

- **Plasma:** 4th state of matter
- **Process**
  - o UV photons used
  - o Vacuum
  - o Low temperature
  - o H_2O_2 chemical present
- **Advantage**
  - o No toxicity
  - o Shorter time duration
- **Use**
  - o Surgical instruments
    - → Arthroscopes
    - → Ureteroscopes
- **Control: Bacillus Stearothermophilus** (autoclave, Plasma sterilization)



Sterrad

7. Gas Sterilization

- Ethylene oxide (ETO)
- **Side effects**
  - o Highly inflammable
  - o Highly irritant
  - o Highly explosive
- **Uses:**Cardiopulmonary machines
- Control: **Bacillus globigii**

Important Information

- Never use 100% ETO
- 3-10% ETO is enough
- Mix with inert gas because its inflammable

Q6.10: Enlist controls used in different types of sterilisation methods

Answer:

Procedure	Controls
Hot air oven	• B.subtilis • B.atrophaeus • C.tetani
Autoclave	• B.stearothermophilus
Plasma sterilization	• B.stearothermophilus
Filtration	• Brevundimonas diminuta • Serratia
Radiation	• B.pumilus
Gas sterilization	• B. Globigii/atropheus/subtilis

Q6.11: What are the various tests used to assess disinfectants?

Answer:

• Phenol coefficient test / Rideal Walker Test o Compared with phenol o **Disadvantage:** Not tested in presence of yeast	• Modified Rideal walker test/ Chick martin Test o Compare in presence of → Yeast → Soil (organic matter)	• Kalsey Sykes test/ capacity test o Capacity of a disinfectant	• Kalsey Maurer test/ in use test o Usage of disinfectant

Q6.12: Enlist various sporicidal agents

Answer: (Mnemonic: EFGHAPPPT)

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

Q6.13: What is the Spaulding classification of medical instruments?

Answer: Spaulding classification

Critical Device	Semi Critical Device	Non Critical device	Non Critical Surfaces / Medical equipments
• Penetrate/enter sterile sites • HLD (High-level disinfectant)	• Come in contact with mucus membranes • HLD	• Come in contact with skin • Intermediate /LLD (Low level disinfectant)	• Computers, desks, tables • LLD

2. BACTERIOLOGY PART-1

BIG QUESTION 1: What is Bacteriology, and how are bacteria classified?

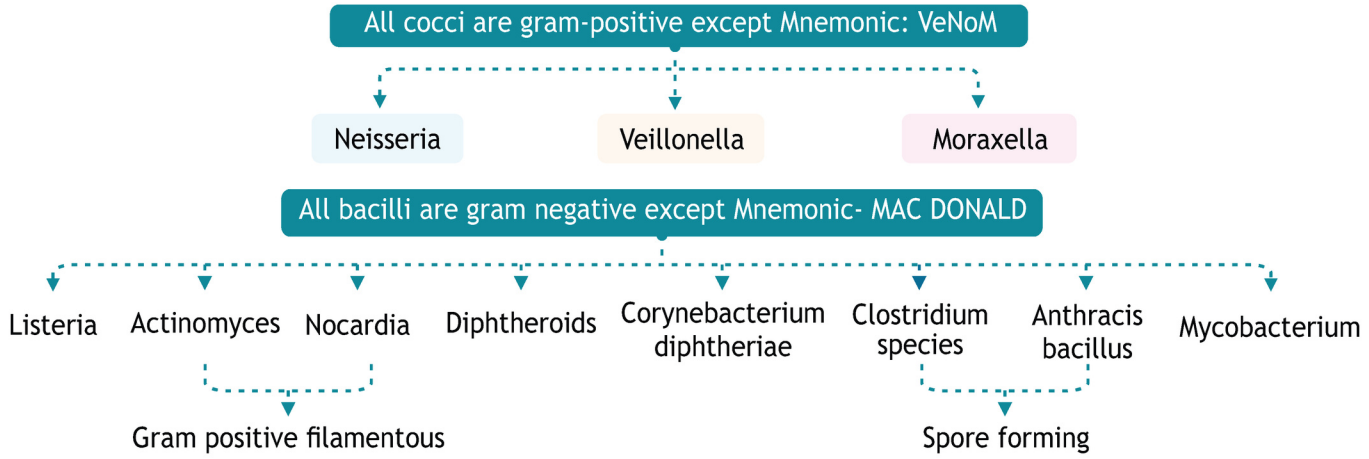
Broad answer:

- **Bacteriology** is the study of bacteria—their structure, classification, functions, and the diseases they cause. Bacteria are **prokaryotic, unicellular organisms**. They can be classified based on:
  - **Gram staining** (Gram-positive or Gram-negative)
  - **Shape** (cocci, bacilli, spiral)
  - **Oxygen requirements** (aerobic, anaerobic)
  - **Spore formation** and **motility**

DETAILED QUESTIONS

Q1.1 What are the exceptions to the general Gram staining rules for cocci and bacilli?

Answer:



BIG QUESTION 2: What are the gram-positive cocci, and What are some important pathogenic members?

Broad answer:

- Gram-positive cocci are spherical bacteria that retain the crystal violet stain during Gram staining, appearing purple under the microscope due to their thick peptidoglycan cell wall.
- Important Genera:
  - Staphylococcus aureus
  - Streptococcus pyogenes (Group A)
  - Streptococcus pneumoniae
  - Enterococcus faecalis

DETAILED QUESTIONS

Q2.1: What are the features of Micrococcaceae members?

Answer:

Micrococcaceae family

Feature	Micrococcus	Staphylococcus
Shape	Tetrads	Bunch of grapes
Glucose utilization	**Oxidative**	**Fermentative**
Oxidase	Positive	Negative
Catalase	Positive	Positive

BIG QUESTION 3: What are the morphological features, virulence factors, diseases caused by Staphylococcus aureus?

Broad answer:

- Staphylococcus is classified under the Micrococcaceae family. It is an oxidase-negative and catalase-positive gram-positive cocci shaped like a bunch of grapes.

DETAILED QUESTIONS

Q3.1: What are the virulence factors of Staphylococcus aureus and their properties?

PYQ: AIIMS 2022
PYQ: FMGE 2022

Answer:

Protein A	• Anticomplementary • Antiphagocytic • Co-agglutination
Enzymes	• Thermonuclease • DNAase • Phosphatase • Catalase • Coagulase
Toxins	• Hemolysins o α, β, δ and γ hemolysins o B-hemolysin is known as sphingomyelinase o Sphingomyelinase shows a hot-cold phenomenon • Panton-Valentine toxin (PVT) o Associated with MRSA o Synergohymenotropic toxin o Synergistic action between PV toxin and γ-hemolysin • Epidermolytic /Exfoliative toxin o Staphylococcal scalded skin syndrome (SSSS) o Ritter's syndrome in children o Toxic epidermal necrolysis (TEN) • Enterotoxin F o Toxic shock syndrome (TSS) o No food poisoning o Cause: Prolonged tampon use o Superantigen

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Q3.2: Explain in detail the enterotoxins causing food poisoning.

PYQ: NEET PG 2022
PYQ: AIIMS 2018

Answer:

- Enterotoxins A-I (not F) cause food poisoning
- Incubation period: <6 hours
- Organisms that have enterotoxins and cause food poisoning with an incubation period shorter than 6 hours
  - Staphylococcus aureus- Food poisoning caused by the consumption of meat and milk
  - Bacillus cereus- Food poisoning caused by the consumption of Chinese fried rice
- Vomiting occurs due to the vagomimetic action of enterotoxins

Q3.3: What are the clinical features of staphylococcal infection?

Answer:

Mnemonic: SOFT PAINS

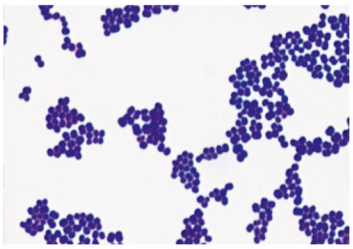


- **S**kin and soft tissue infections.
  - Botryomycosis (bunch of grapes)
- **O**steomyelitis
  - The most common cause is *Staphylococcus aureus*.
- **F**ood poisoning with an incubation period < 6 hours.
- **T**oxic shock syndrome.
- **T**oxic epidermal necrolysis.
- **P**neumonia
  - The most common causes of hospital-acquired pneumonia and ventilator-acquired pneumonia.
- **P**neumatocele
- **A**cute infectious endocarditis.
  - The most common cause of acute infective endocarditis and native valve infective endocarditis.
- **I**nfective arthritis
- **N**ecrotizing fasciitis
- **S**epsis

Q3.4: What is the microscopic appearance of Staphylococcus aureus?

Answer:

- Gram-positive cocci and Grape clusters





Q3.5: Which culture media are used to diagnose Staphylococcus aureus, and what are their findings?

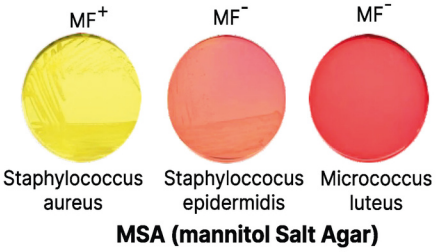
Answer:

Nutrient agar	• Non-diffusible golden pigment • β-carotene • Staphyloxanthene

Blood agar	• Narrow zone of hemolysis 
Selective media	• Positive mannitol fermentation - Differential media • S. aureus requires salt to grow - Selective media • Colour change to yellow - Indicator media (Phenol red indicator)

Q3.6: How does Staphylococcus aureus differ from other cocci on Mannitol Salt Agar (MSA)?

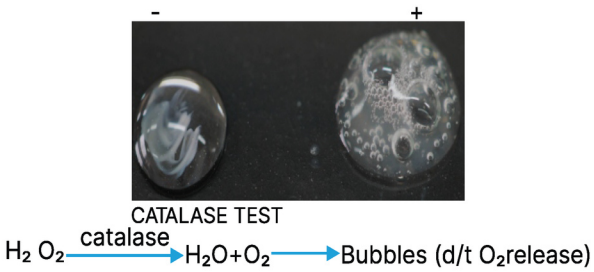
Answer:



Q3.7: What is the catalase test?

Answer: Staphylococcus aureus is a catalase positive organism

- A bubbly appearance indicates a positive catalase test



Q3.8: What are some important catalase positive organisms?

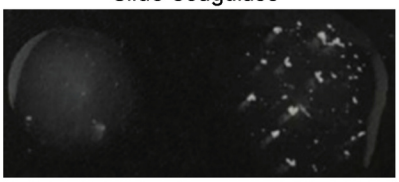
Answer:

- Staphylococcus aureus > Golden colour
- Serratia > Red color
- Pseudomonas > Blue-green color
- Aspergillus
- Candida
- Cryptococcus
- Escherichia coli
- Enterobacteriaceae family
- Bacillus anthracis
- Neisseria gonorrhoea
- Neisseria meningitidis

- Mycobacterium tuberculosis
- Micrococcus

Q3.9: What is the difference between slide coagulase and tube coagulase tests?

Answer:

Feature	Slide coagulase	Tube coagulase
Also known as	• Bound coagulase. Slide Coagulase  Negative Positive	• Free coagulase. Tube Coagulase  Negative Positive
Positive in	• S. Aureus • S. Intermedius • S. Hyicus • S. Lugdunensis	• S. Aureus • S. Intermedius • S. Hyicus • S. Schleiferi
Chemical reactants	• Clumping factor	• Coagulase reacting factor (CRF).

Q3.10: What drugs are used in the treatment of Staphylococcus aureus?

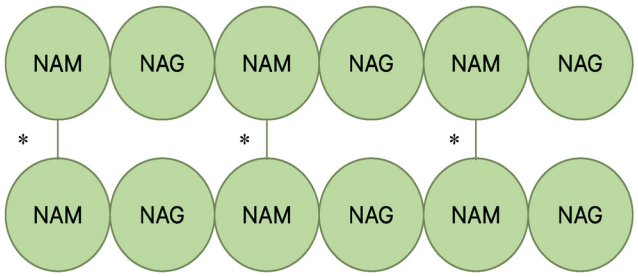
Answer:

- Penicillin/ß-lactam
- Methicillin is used to treat Penicillin resistance
- Vancomycin and daptomycin are used for Methicillin resistance

Q3.11: What is the MOA of ß-lactams?

Answer:

- ß-lactams bind to penicillin-binding proteins (PBPs) or transpeptidases on S. aureus, leading to their breakage



Q3.12: How does Staphylococcus aureus develop resistance to ß-lactams?

Answer:

- S. aureus produces ß-lactamase
- ß-lactamase production is facilitated by the **BLA gene** and transmitted/coded via plasmids
- Transfer to other bacteria occurs by transduction and conjugation
  - **Transduction > Conjugation**

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Q3.13: How does Staphylococcus aureus develop resistance to Methicillin?

Answer:

- Gene involved: **Mec A gene**
- PBP changes to PBP2a, which has a lesser affinity for antibiotic binding.

Q3.14: What are the diagnostic tests used for Methicillin-resistant Staphylococcus aureus?

Answer:

- Cefoxitin disc diffusion agar/Oxacillin
- Latex agglutination for PBP2a
- ELISA for MecA
- PCR for MecA

Q3.15: What are VISA and VRSA, and how do they differ in terms of vancomycin resistance and MIC values?

Answer:

VISA	VRSA
• Vancomycin-intermediate S. aureus o Lesser resistance • MIC for VISA: >4-8 µg/ml vancomycin	• Vancomycin-resistant S. aureus • Minimum inhibitory concentration (MIC) for VRSA: >16 µg/ml vancomycin

Q3.16: What are the Coagulase-Negative Staphylococcus (CONS)?

Answer:

PYQ: NEET PG 2023

Feature	S. Epidermidis	S. Saprophyticus
Common	More common	Less common.
Causes	**Prosthetic heart valve endocarditis**	**UTI**
Novobiocin	Sensitive	-
Resistance to antibiotic	**Biofilm production**	-

BIG QUESTION 4: What are the morphological features, classifications, virulence factors, diseases caused by Staphylococcus aureus?

Broad answer:

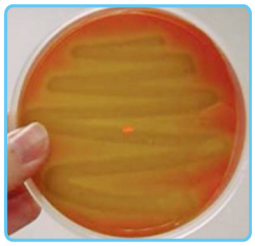
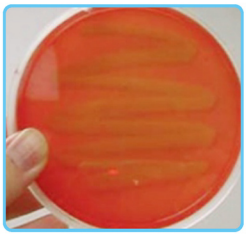
- General Features Streptococcaceae
  - o Gram-positive cocci
  - o Arranged in chains or pairs
  - o Catalase-negative (unlike staphylococci)
  - o Facultative anaerobes
  - o Grow well on blood agar and show hemolysis patterns (important for classification)

DETAILED QUESTIONS

Q4.1: How are streptococci classified based on hemolysis on blood agar?

Answer:

YOURWISH

α hemolysis	β hemolysis	γ hemolysis
• Green colour	• Yellow colour	• No hemolysis
• S. viridans • S. pneumoniae	• S. pyogenes • S. agalactiae	• Enterococcus
 Alpha Hemolysis	 Beta Hemolysis	 Gamma Hemolysis

Q4.2: Elaborate on the Lancefield classification of β hemolytic Streptococci

PYQ: FMGE 2023

Answer:

- Based on the C antigen
- Classes A-V, no I and J
- **Group A β hemolytic streptococci - S. pyogenes**
- **Group B β hemolytic streptococci - S. agalactiae**
- Group A can be subdivided further based on their typing
  - o Griffith typing- M protein
  - o EMM typing- Gene for M protein

Q4.3: What are the virulence factors of Streptococcus pyogenes?

Answer:

Enzymes	• Streptokinase • Hyaluronidase • DNAse-A, B, C, and D o DNAse B o Anti-DNAse B is used in testing for pyoderma and post-streptococcal glomerulonephritis (PSGN) • Hemolysin/Streptolysin
Toxins	• Streptococcal pyrogenic exotoxin (SPE) A, B, C o Scarlet fever o Toxic shock syndrome

NOTE: TSS may be caused by Staphylococcus aureus or Streptococcus pyogenes.

Q4.4: What is Anti-streptolysin antibody testing?

Answer:

Feature	Streptolysin O antigen (SLO)	Streptolysin S antigen
O_2 and heat	Labile	Stable
Serum	Stable	Soluble
Property	Antigenic	Non-antigenic
Hemolysis	Deeper	On the surface

Q4.5: What are the suppurative clinical signs of Streptococcus pyogenes?

Answer:



Mnemonic: **NIPPLES**

- **N**ecrotizing fasciitis
- **I**mpetigo
- **P**haryngitis
- **P**neumonia
- **L**ymphangitis
- **E**rysipelas
- **S**carlet fever

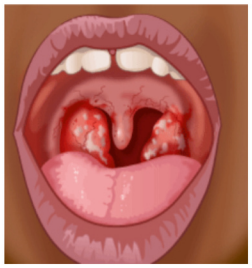
Q4.6: What are the non-suppurative clinical signs of Streptococcus pyogenes?

Answer:

- Rheumatic heart disease
- Post-streptococcal glomerulonephritis (PSGN)
- **PANDAS- neuropsychiatric disorder**

Q4.7: What is the clinical presentation and treatment of Pharyngitis associated with Streptococcus pyogenes?

Answer:

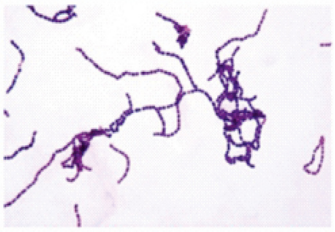
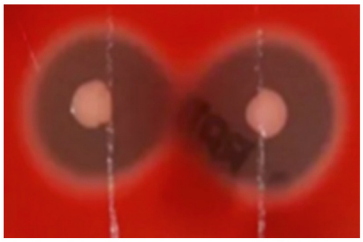


- Clinical presentation of Pharyngitis associated with S. pyogenes
  - Pain
  - Tender cervical lymphadenopathy
  - No cough
- Treatment: Penicillin

Q4.8: What are the laboratory diagnostic tests used to diagnose Streptococcus pyogenes?

PYQ: AIIMS 2018

Answer:

Microscopy	• Appears as Chains 
Blood agar	• Pin-point colonies • Wide zone of hemolysis 
Transport medium	• Pike's media
Selective media	• PNF • CVBA (Crystal violet blood agar) • In Liquid media, Granular turbidity is seen

Biochemical test	• Catalase negative • Oxidase negative • PYR test positive • Bacitracin sensitive

Q4.9: What are the treatment options for Streptococcus pyogenes?

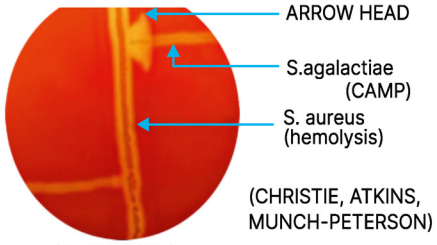
Answer:

- Penicillin
- Erythromycin in case of resistance

Q4.10: What are the laboratory diagnostic tests used to diagnose Group B Streptococcus?

Answer: Group B Streptococcus - Streptococcus agalactiae

- CAMP test positive
  - o Arrowhead hemolysis
- Hippurate hydrolysis positive
- Bacitracin resistant
- Red pigment on Islam media



CAMP TEST+in S. AGALACTIAE (Group B)

Q4.11: What diseases are caused by Streptococcus agalactiae?

Answer:

- Meningitis
- Pneumonia
- Septicemia

Q4.12: What are the differences between members of α (alpha) hemolytic streptococci?

Answer:

Feature	S. viridans	S. pneumoniae
Arrangement	Chains	Lens-shaped **(Lanceolate)** 
Bile solubility	Insoluble	Soluble
Optochin	Resistant	Sensitive
Inulin fermentation	Not seen	Seen

Q4.13: What are the organisms classified under Streptococcus viridans, and the diseases caused by them?

Answer: PYQ: AIIMS 2021

- S. mitis
- S. mutans: Dental caries
- S. sanguis: Late prosthetic heart valve endocarditis
- S. salivaris: Capsule and slime layer

Q4.14: What are the clinical features, diagnosis, treatment, and prevention methods of Streptococcus pneumoniae/Pneumococcus?

Answer:

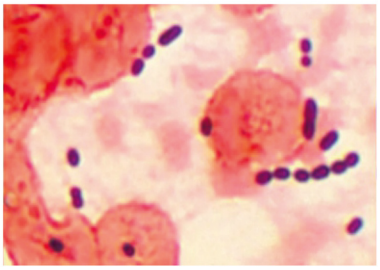
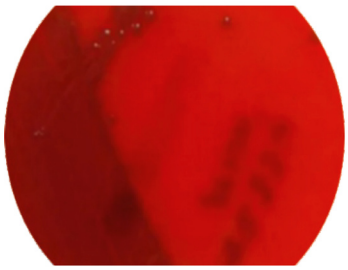
General features	• Capsular polysaccharide • > 90 known serotypes • Quellung reaction
Clinical features	• Meningitis • Otitis media • Sinusitis • Community-acquired pneumonia.
Diagnosis	Microscopy • Carrom coin colonies or Draughtsman colonies • Autolysin (amidase)  Depressed Centre with an elevated rim
Treatment	• ß-lactams
Prevention	Pneumovax • 23-valent PPV polysaccharide vaccine • Given to children above 2 years old Prevnar • 13 valent • Can be given to children below 2 years old

Q4.15: What are the features and treatment of enterococcal infections?

Answer:

Microbiological features	• γ-hemolytic streptococci • Spectacle-shaped • Non-motile • Non-sporing • Tolerates NaCl 6.5% • Heat tolerant • Tolerates 40% bile • Black colour in Bile Esculin Azide agar (BEA)

YOURWISH

	• PYR positive • Causes: UTI & Septicemia     Positive Negative **BEA Agar: Turns black d/t aesculin hydrolysis**
Treatment	• Penicillin • Vancomycin in case of penicillin resistance • Linezolid in case of vancomycin resistance

Q4.16: How does Enterococcus cause Vancomycin resistance?

Answer:

- Vancomycin-resistant enterococcus (VRE) is caused by the Van A gene
- D-ala-D-ala in bacteria changed to **D-ala-D-lactate or D-ala-D-serine**

BIG QUESTION 5: What are the morphological features, virulence factors, clinical manifestations, and management of Gram-negative cocci?

Broad answer:

- Gram-negative cocci are spherical bacteria that do **not retain the crystal violet stain** during Gram staining due to their **thin peptidoglycan layer** and **outer membrane** rich in lipopolysaccharide (LPS). Gram-negative cocci include:
  - o Moraxella
  - o Veillonella
  - o Neisseria

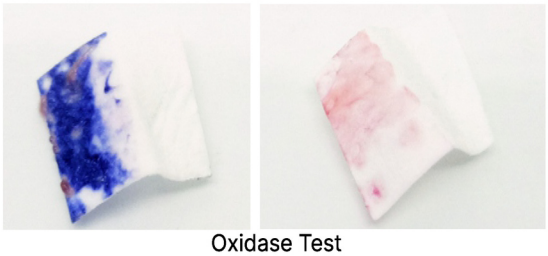
DETAILED QUESTIONS

PYQ: NEET PG 2019,2021,2023 PYQ: AIIMS 2018 & 2020 PYQ: FMGE 2018 & 2021

Q5.1: List the distinguishing microbiological features of Neisseria meningitidis and Neisseria gonorrhoeae.

Answer:

Feature	N. meningitidis	N. gonorrhoeae
Habitat	Nasopharynx	Genitals
Disease	Meningitis	Gonorrhea

Fermentation	Glucose Maltose	Glucose
Shape	Lens-shaped Capsule present	Kidney-shaped
Catalase	Positive	Positive
Oxidase	Positive Positive Negative  Oxidase Test	Positive
Oxygen requirement	Strict aerobe	Facultative anaerobe
Virulence factors	**Capsular polysaccharide A, B, C, Y, W135.**	
	Outer membrane protein (OMP)	OMP **Protein I (PORB1a and PORB1b).** Protein II
	IgA protease	IgA protease
	Endotoxin	Endotoxin
	Type IV pili(motile)	Type IV pili
Transport media	Amies/Stuart media.	Amies/Stuart media.
Culture media	Modified Thayer-Martin medium.	Modified Thayer-Martin medium.
Treatment	IV ceftriaxone	IV ceftriaxone for gonorrhea add-Azithromycin

Q5.2: What are the diseases caused by Neisseria meningitidis?

Answer:

- Pyogenic meningitis
- Bilateral adrenal haemorrhage
  - Waterhouse-Friedrichsen syndrome (meningococcemia)

Q5.3: What are the diseases caused by Neisseria gonorrhoeae?

Answer:

- Ophthalmia neonatorum
- Urethritis (Most common presentation in males) and Cervicitis (Most common presentation in females), i.e, multiple discharging sinuses

Q5.4: What are the complications of gonorrhoeal infection?

Answer:

- Fitz-Hugh-Curtis syndrome
  - Perihepatitis
  - Also seen in Chlamydia trachomatis
- Disseminated gonococcal infection (DGI) - PORB1a

Q5.5: Against which serotypes does the meningococcal vaccine provide protection?

Answer:

- Meningococcal vaccine protects against A, C, Y, and W135 serotypes
- Does not protect against the B serotype

Q5.6: What are the antibiotics used in Modified Thayer-Martin medium?

Answer:

- Vancomycin
- Colistin
- Nystatin
- Trimethoprim

Q5.7: Name the diseases caused by Moraxella Catarrhalis.

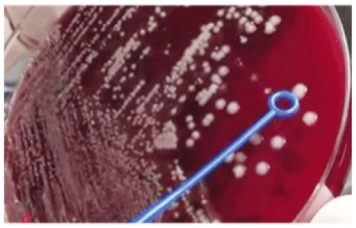
Answer:

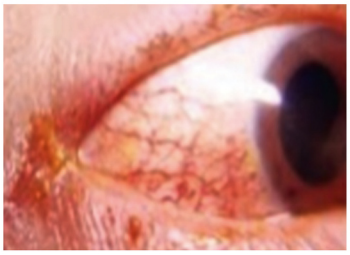
- Otitis media
- COPD exacerbations
  - The most common infection in COPD is Haemophilus influenzae
  - The 2nd most common infection in COPD is Moraxella catarrhalis

Q5.8: What sign is noticed in the culture of Moraxella Catarrhalis?

Answer:

- Hockey puck sign





Q5.9: Angular conjunctivitis is caused by which organism?

Answer:

- Moraxella Lacunata causes Angular conjunctivitis

BIG QUESTION 6: What are the morphological features, pathogenic mechanisms, clinical manifestations, diagnosis, and prevention strategies of Corynebacterium diphtheriae?

Broad Answer: Corynebacterium diphtheriae is a Gram-positive, club-shaped bacillus known for causing diphtheria, a toxin-mediated upper respiratory tract infection. It spreads via respiratory droplets and produces a pseudomembrane in the throat, with complications due to its exotoxin.

DETAILED QUESTIONS

Q6.1: What toxin does Corynebacterium diphtheria contain?

PYQ: FMGE 2021

Answer:

- Corynebacterium diphtheria contains Diphtheria toxin, which is dependent on iron levels.

PYQ: AIIMS 2019

Q6.2: How is the Toxoid vaccine prepared?

Answer:

- Toxoid vaccine is formed from Diphtheria toxin by acid and formalin solution

Q6.3: Name the toxins that decrease protein synthesis, and by what mechanism do they do so?

Answer:

- Toxins that decrease protein synthesis (Mnemonic: DPSS)
  - Diphtheria toxin
  - Exotoxin A of Pseudomonas
  - Shiga toxin - Shigella
  - Shiga-like toxin/Verocytotoxin - E. coli
- Mechanisms
  - Diphtheria toxin and exotoxin A of Pseudomonas cause **ADP ribosylation of Elongation Factor-2 (Ef2)**
  - Shiga and Shiga-like toxins inhibit 60S ribosomes

Q6.4: What are the forms of Corynebacterium diphtheria, and how do they manifest?

Answer:

Forms		
Respiratory/Faucial diphtheria (most common)	Cutaneous diphtheria	Systemic diphtheria
• **Bull's neck.** • Pseudomembrane on soft palate. • Most common form.	• Ulcers	• Multi-organ involvement. • CNS and PNS involvement.

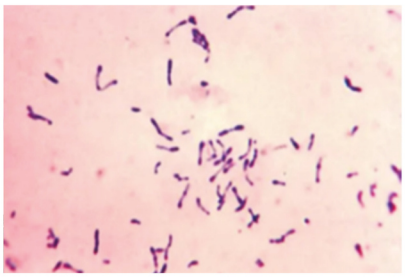



Q6.5: What are the microscopic findings of Corynebacterium diphtheriae?

PYQ: FMGE 2019,2020,2021

Answer:

- Sample collection: 2 swabs taken from the area below the pseudo membrane
- Appearance: **Chinese letter/Cuneiform appearance**
  - V-shaped and L-shaped: Due to the snapping division
- Volutin granules / Babes Ernst granules / Bipolar granules/Metachromatic granules
  - Composition: **Polymetaphosphate for energy**

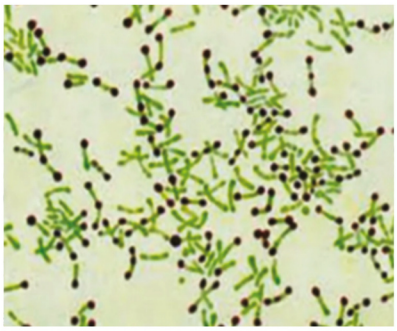


Q6.6: What stains are used in the diagnosis of Corynebacterium diphtheria?

PYQ: AIIMS 2018,2020

Answer:

- Albert stain (Mnemonic: TIM)
  - Albert 1 solution
    - → Toluidine blue
    - → Malachite green
  - Albert 2 solution
    - → Iodine
- Ponder's stain



YOURWISH

- Loeffler's Methylene blue stain: Best stain of choice
- Neisser stain

Q6.7: What are the enriched media used for Corynebacterium diphtheriae?

Answer:

- C. diphtheria, also known as the Klebs-Loeffler bacillus
- Enriched media used:
  - Loeffler serum slope
  - 6-8 hours to grow
  - Best media for early diagnosis

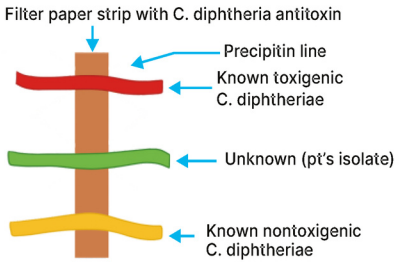
Q6.8: What is the selective media to grow Corynebacterium diphtheria?



Answer:

- Potassium tellurite agar/Tinsdale media: Gives black colour colonies
- 48 hours to grow
- Best media for C. diphtheria

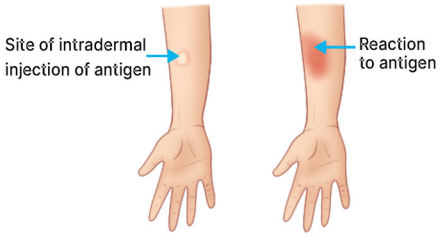
Q6.9: What is the purpose of Elek's gel precipitation test, and how is it interpreted?



Answer:

- Done to know the Toxigenicity of bacteria
- Double diffusion in two dimensions
- Filter paper strip with C. diphtheria antitoxin
  - Toxigenic strain produces a precipitin line
  - Non-toxigenic strain does not produce a precipitin line

Q6.10: What is the purpose of the Schick test, and how is it interpreted?



Answer:

- To determine the susceptibility to Corynebacterium diphtheria
- Intradermal test
- Interpretation:
  - Redness (positive reaction) indicates susceptibility
  - Negative reaction indicates immunity

Q6.11: How are Corynebacterium species biotyped based on colony morphology and virulence?

Answer:

Bio-typing of Corynebacterium species (Mnemonic: GIM) Based on growth in selective media.		
C. Gravis	C. Intermedius	C. Mitis
• Daisy head colonies. • Starch fermentation.	• Frog egg colonies. • Non-hemolytic.	• Poached egg colonies. • Least virulent. • Minimal infection.

Q6.12: Elaborate on the treatment options for diseases caused by Corynebacterium diphtheria.

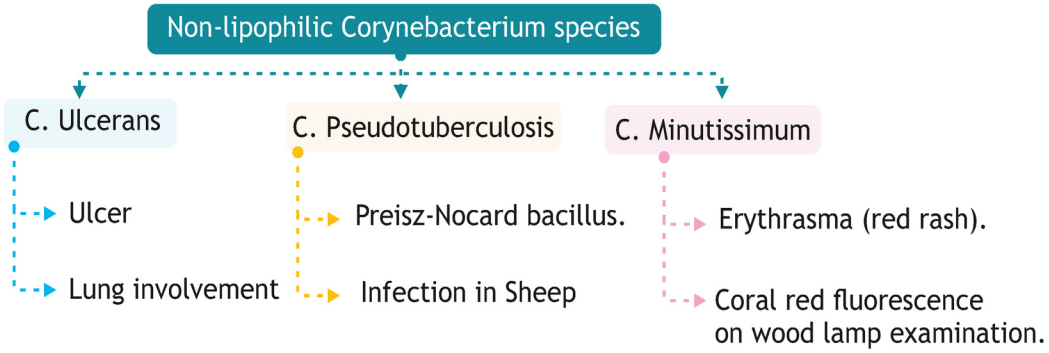
Answer:

Type of Disease	Diphtheria antitoxin	Antibiotics	Adjunctive
Pharyngeal/Laryngeal Disease lasts < 3 days	20,000 - 40,000 IM or IV	Penicillin or erythromycin.	Droplet precaution.
Nasopharyngeal	40,000 - 60, 000 IM or IV	Penicillin or erythromycin.	Droplet precaution.
Extensive	80,000 - 1,20, 000 IM or IV	Penicillin or erythromycin.	Droplet precaution.
With neck disease or disease > 3 days	Half dose IM Half dose IV	Penicillin or erythromycin.	Droplet precaution.

- The treatment of choice is diphtheria antitoxin

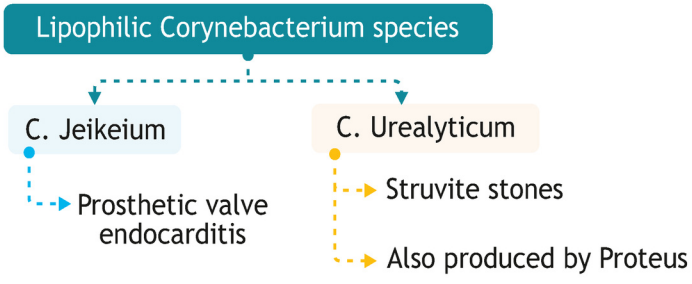
Q6.13: What are non-lipophilic Corynebacterium species, and what diseases do they cause?

Answer:



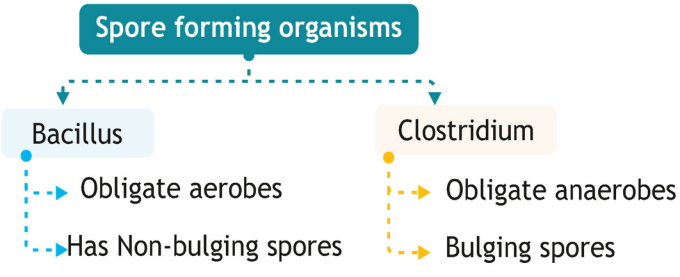
Q6.14: What are lipophilic Corynebacterium species, and what diseases do they cause?

Answer:



BIG QUESTION 7: What are the morphological features, types, clinical significance, and diagnostic methods of spore-forming bacteria?

Broad answer: Spore-forming bacteria, primarily Bacillus and Clostridium species, produce endospores to survive extreme conditions. These spores are highly resistant and play a key role in the pathogenesis of diseases like tetanus, botulism, and anthrax.



DETAILED QUESTIONS

Q7.1: What are the major virulence factors of Bacillus anthracis?

PYQ: NEET PG 2019,2020
PYQ: FMGE 2019,2023

Answer:

- Capsule
  - Polypeptide (made of Polyglutamate)
- Anthrax toxin (mnemonic: EPL: english premiere league)
  - Tripartite
  - Edema factor - Increases cAMP
  - Protective factor - Attachment
  - Lethal factor - Death

Q7.2: What are the different types of anthrax, their modes of transmission, and associated clinical features?

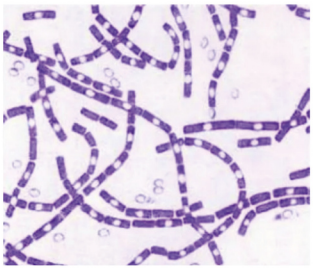
Answer:

Types of anthrax		
Cutaneous anthrax: Hide-Porters disease	**Pulmonary anthrax: Wool sorter's disease**	**Intestinal anthrax**
• Skin-to-skin contact. • **Malignant pustule: Eschar (black).** 	• Hemorrhagic mediastinitis. • Most common form associated with **bioterrorism.**	• Undercooked meat. • **Hemorrhagic enteritis.**

Q7.3: What are the microscopic features of Bacillus anthracis?

Answer:

- On microscopy, Bacillus anthracis shows:
  - Bamboo stick or box car appearance
  - Medusa head appearance





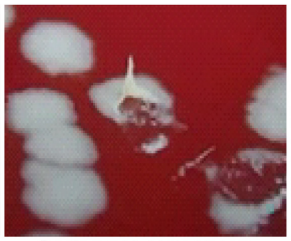
Q7.4: How does Bacillus anthracis appear on blood agar?

Answer:

- On Blood agar, Bacillus anthracis gives 3 distinct appearances, namely:
  - Frosted glass appearance
  - Comet tail appearance
  - Beaten egg appearance


Frosted glass appearance

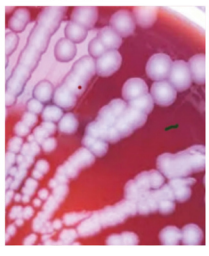

Comet tail appearance


Beaten egg appearance

Q7.5: What is the appearance of Bacillus anthracis on Penicillin agar?

Answer:

- On Penicillin agar, Bacillus anthracis shows a string of pearls appearance



YOURWISH

Q7.6: What appearance is shown by Bacillus anthracis on Gelatin stab?

PYQ: AIIMS 2021

Answer:

- Bacillus anthracis on Gelatin stab shows an inverted fir tree appearance



Gelatin Liquefaction

Q7.7: What are the characteristic appearances produced by different bacteria in a gelatin stab?

Answer:

- Inverted fir tree - B. anthrax
- Fir tree - Clostridium tetani
- Turnip/napiform - Vibrio cholerae

Q7.8: What are the selective media and serological tests used in the diagnosis of Anthrax?

Answer:

- Selective media
  - o PLET media
- Serology
  - o Ascoli's ring thermo precipitin test
  - o ELISA

Q7.9: Elaborate on the treatment options available for Anthrax.

Answer:

Uncomplicated cutaneous anthrax	• Ciprofloxacin or doxycycline. • 7-10 days.
Systemic involvement	• Add antitoxin. • Monoclonal Antibody: Raxibacumab
Anthrax meningitis	• 60-day antibiotic regimen • Ciprofloxacin • Meropenem • Clindamycin
Post-exposure prophylaxis (PEP)	• 60-day antibiotic regimen + • AVA Biothrax

Q7.10: What type of organism is Bacillus cereus?

Answer:

- Bacillus cereus is a spore-forming, motile, and non-capsulated bacterium.

Q7.11: What types of infections are caused by Bacillus cereus?

Answer:

Feature	Emetic type	Diarrheal type
Incubation period	1-5 hours	8-16 hours
Food	Chinese fried rice	Meat and milk
Mechanism of action	**Increased cGMP**	**Increased cAMP**

Q7.12: Which selective media is used to culture Bacillus cereus?

Answer:

- Mannitol, yolk, polymyxin, agar (MYPA)
- Polymyxin, mannitol, bromothymol blue (PEMBA)

Q7.13: What is the most common location of spores in Clostridium species?

PYQ: FMGE 2021

Answer:

- The most common location of the spore in Clostridium species is sub-terminal.

Q7.14: Name the Clostridium species with terminal spores.

Answer:

- Clostridium species with terminal spores
  - C.tetani: Drumstick appearance
  - C.tertium: Tennis racket appearance

Q7.15: Name the spore-forming bacteria with central spores.

Answer:

- B.cereus
- C.bifermentans

Q7.16: Name the two Clostridium species that are capsulated.

Answer:

- Most Clostridium species are non-encapsulated, except (mnemonic: PCB)
  - C.perfringens
  - C.butyricum

Q7.17: Name the two Clostridium species that are non-motile.

Answer:

- All Clostridium species are motile, except
- C.perfringens

Q7.18: How does gas gangrene present clinically?

Answer:

- The most common cause of gas gangrene: Clostridium perfringens
- Clinical presentation of gas gangrene
  - Pain
  - Discharge (necrotic tissue)
  - Gas bubbles and crepitus



Q7.19: Name the organisms that cause gas gangrene.

Answer:

- Organisms that cause gas gangrene
  - C. perfringens
  - C. septicum (Citron body)
  - C. novyi

Q7.20: What are the treatment options for gas gangrene?

Answer:

- Surgical debridement
- IV penicillin + Clindamycin for 10-14 days
- Hyperbaric oxygen therapy

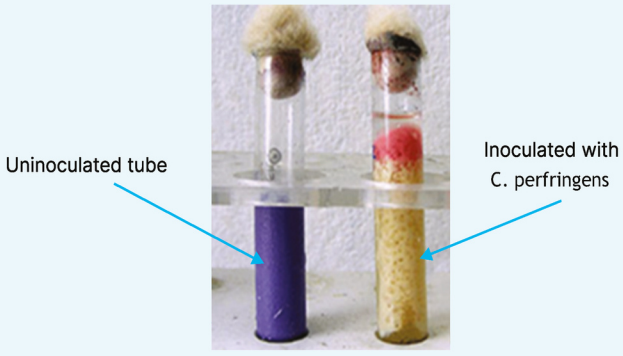
Q7.21: What are the diseases caused by Clostridium perfringens?

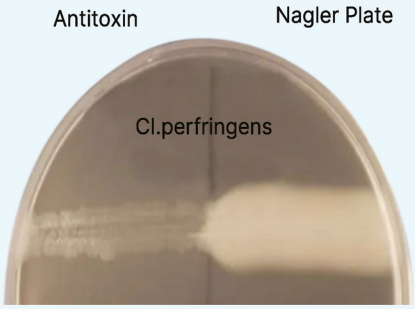
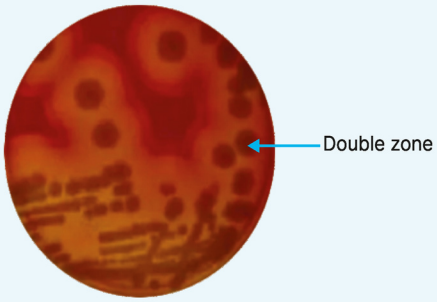
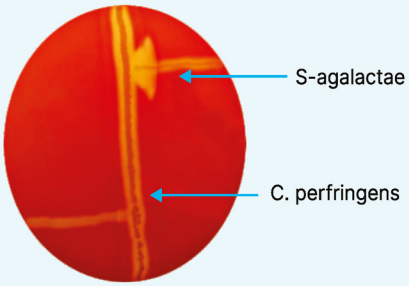
Answer:

- Food poisoning
  - Due to cold and warmed up meat
- Necrotizing enteritis
- Pigbel disease
  - A type of food poisoning caused by to consumption of pork and sweet potatoes

Q7.22: Write in detail about the diagnostic modalities of Clostridium perfringens.

Answer:

Robertson's cooked meat broth (RCMB)	• Anaerobic organisms • Pink color • Saccharolytic reaction
Litmus milk test (Mnemonic: senior NTR)  Litmus milk test with 'stormy clot reaction'	• Stormy clot formation in the litmus milk test

Positive Naegler's reaction  Nagler's Reaction	• Due to "α toxin or lecithinase" • Egg yolk agar
Target hemolysis  Target Hemolysis	• Double zone hemolysis o Inner zone: θ toxin o Outer zone: α toxin
Positive reverse cAMP test  Reverse CAMP test	• Arrowhead enhanced hemolysis

Q7.23: What is the toxin responsible for the muscle spasm caused by Clostridium tetani?

Answer:

- The toxin responsible for the muscle spasm caused by Clostridium tetani is tetanospasmin.

Q7.24: What is the difference between tetanospasmin and tetanolysin?

Answer:

- Tetanospasmin is oxygen stable, while tetanolysin is oxygen labile
- Both tetanospasmin and tetanolysin molecules are heat-labile.

Q7.25: What is the first muscle to be affected in tetanus?

Answer:

- The 1st muscle to be affected is the masseter muscle
  - Lockjaw/Trismus

Q7.26: What are the complications of tetanus?

Answer:

- Risus sardonicus
- Opisthotonus position

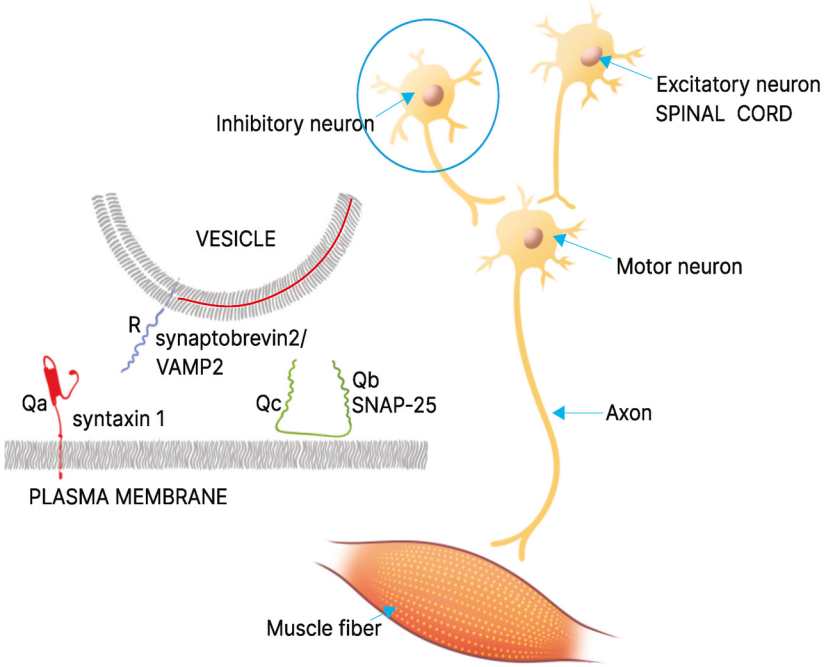




Q7.27: What is the mechanism of action of Clostridium tetani toxin?

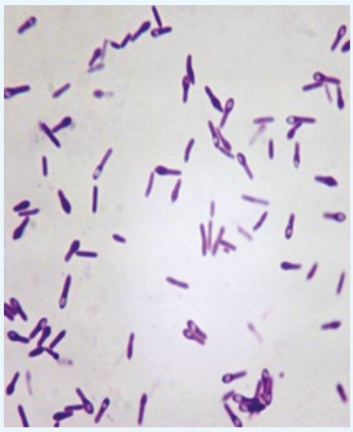
Answer:

- C. tetani acts pre-synaptically at the inhibitory neuron terminal
- Prevents GABA and glycine release
- The same effect can be seen in strychnine poisoning
  - o Acts post-synaptically.



Q7.28: Elaborate on the diagnostic modalities for Clostridium tetani

Answer:

Microscopy	• Drumstick appearance
 Terminal Spores	

YOURWISH

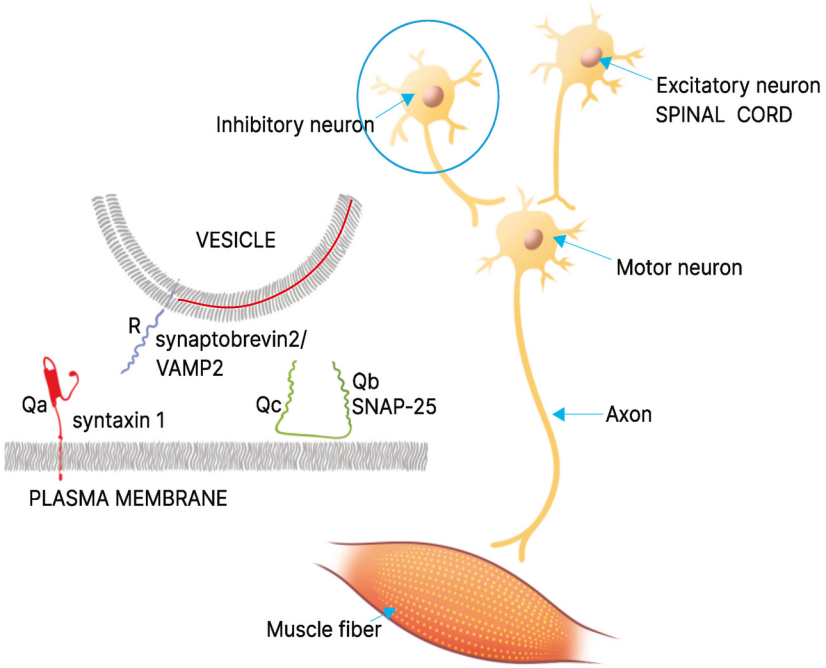
RCMB media  Proteolytic reaction	• Black color • Proteolytic reaction
Blood agar  Swarming	• Swaring
Gelatin swab	• Fir tree appearance

PYQ: AIIMS 2019

Q7.29: What is the mechanism of action of Clostridium botulinum?

Answer:

- Injury exposes muscle fiber to an organism
- Acts pre-synaptically on excitatory neurons
- Inhibits acetylcholine release and contraction



Q7.30: What are the types of botulism and what are their features?

Answer:

Types of botulism		
Food-borne botulism	**Infant botulism**	**Other types include**
• Canned food • Diplopia • Dysphagia • Dysarthria • Descending flaccid paralysis • Dilated pupils	• Bottle-fed, honey, or baby food. • 1st symptom is constipation. • **Floppy baby syndrome.**	• Wound botulism. • Iatrogenic botulism.

Q7.31: What are the etiology and clinical features of C. difficile infection?

PYQ: NEET PG 2022

Answer:

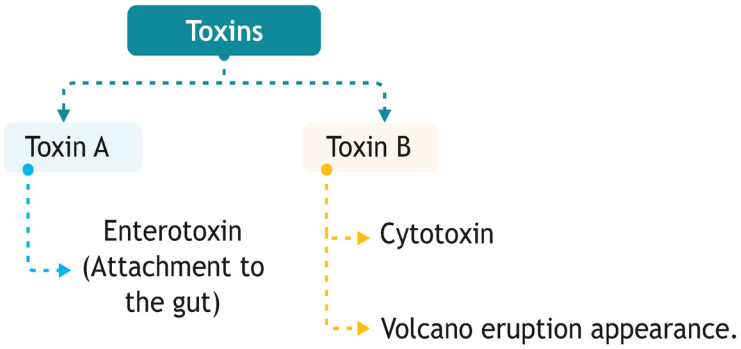
- Clostridium difficile, AKA Clostridioides difficile, causes Pseudomembranous enterocolitis (PMEC), resulting in pseudomembrane formation
- Etiology: Long-term use of antibiotics(Alteration of gut flora)
- Clinical features: Watery diarrhea

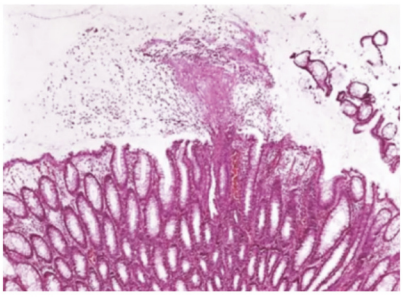


Dirty yellow necrotic membrane present on mucosa

Q7.32: What are the two main types of Clostridium difficile toxin and what are their features?

Answer:





Volcano eruption in pseudomembranous enterocolitis

Q7.33: What are the diagnostic modalities of Clostridium difficile?

Answer:

- Toxins
  - ELISA
  - PCR
- Culture media
  - Cefoxitin cycloserine fructose agar (CCFA)
  - Cefoxitin cysteine yeast extract agar (CCYA)

Q7.34: What are the treatment options for Pseudomembranous enterocolitis?

Answer:

- Pseudomembranous enterocolitis can be treated by using:
  - Fidaxomycin
  - Vancomycin

BIG QUESTION 8: What are the morphological features, clinically important species, diseases, and diagnostic methods associated with filamentous Gram positive bacteria?

Broad answer:

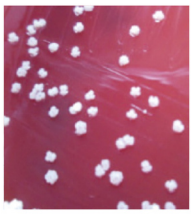
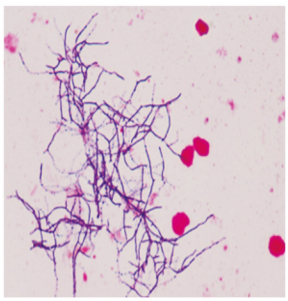
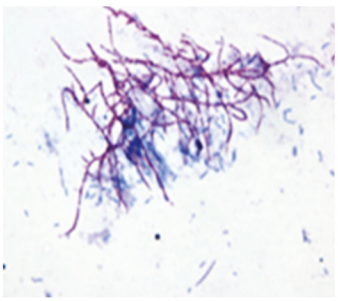
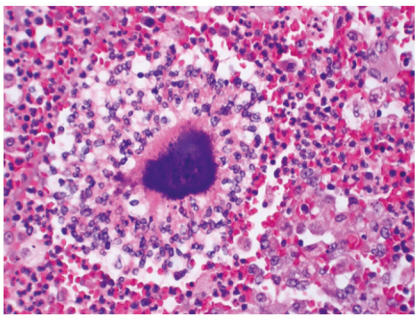
- Filamentous gram-positive bacilli" refers to bacteria that grow in long, thread-like structures and stain purple with a Gram stain, indicating a thick cell wall. Bacteria include:
  - o Nocardia
  - o Actinomyces

DETAILED QUESTIONS

Q8.1: Write in detail the key differences between Nocardia and Actinomyces.

PYQ: AIIMS 2019,2022

Answer:

Nocardia	Actinomycetes
Strict aerobe.	Strict anaerobe.
1% acid-fast.	Non-acid fast.
Soil. (Exogenous organisms)	Mouth. (Endogenous flora)
The most common site is pulmonary (lung). Lymphadenopathy absent.	The most common site is the jaw.
The most common extrapulmonary site is the brain.	Oral cervical actinomycosis triad.
Culture - Paraffin bait technique.	Culture: **Molar tooth appearance on solid media.**  
Sulfonamides	Penicillin
Microscopy   • Purple color in gram stain. • Filamentous • Red color in ZN stain.	**Microscopy**  • Sun ray appearance. • **Splendore-Hoeppli phenomenon.** o Antigen-antibody reaction. o Also seen with sporothrix fungi.

YOURWISH

Q8.2: What are the conditions caused by Actinomyces Israelii?

PYQ: NEET PG 2018

Answer:

- Actinomyces Israelii is an acid-fast bacilli that causes Pelvic inflammatory disease with Intrauterine contraceptive device usage

BIG QUESTION 9: What are the morphology, pathogenesis, clinical features, diagnosis, and treatment of Listeria monocytogenes infection?

PYQ: FMGE 2021

PYQ: AIIMS 2023

Broad answer:

- Listeria monocytogenes is a Gram-positive, rod-shaped bacterium known for causing listeriosis, a serious foodborne illness.

DETAILED QUESTIONS

Q9.1: What are the key characteristic features of Listeria monocytogenes?

Answer:

- Motility
  - Tumbling motility at 25°C
  - No tumbling motility at 37°C
- Flagella
  - Peritrichous
  - Formed only at 25°C
- Shows β hemolysis
- It is a Catalase positive and cAMP positive
- Cold enrichment- Increased growth at 4°C
- Spread: Contact, Contaminated food, Cheese (dairy)
- Anton test
  - A positive test produces Keratoconjunctivitis when done in animals.

Q9.2: What are the diseases caused by Listeria monocytogenes?

Answer:

- Diarrhea
- Affects females during pregnancy
- Neonatal infection: Granulomatosis infantiseptica

Q9.3: How is Listeria monocytogenes diagnosed and treated?

Answer:

- Diagnosis: By ELISA test
- Treatment: Ampicillin and Gentamycin

BIG QUESTION 10: What are the morphological features, pathogenic species, clinical manifestations, diagnostic techniques, and treatment of Mycobacterium infections?

Broad answer:

- Mycobacterium is a genus of aerobic, non-motile, rod-shaped bacteria that are acid-fast due to the high lipid content (especially mycolic acid) in their cell walls.

DETAILED QUESTIONS

PYQ: AIIMS 2022

Q10.1: What are the key features, and virulence factors of Mycobacterium tuberculosis?

Answer:

- Positive ZN stain
- Acid-fast bacillus because of Mycolic acid
- Virulence due to Cord factor
- Lipoarabinomannan (LAM): Inhibition of phagolysosome formation
- LAM test done in urine
  - Useful for HIV with TB patients
- Most commonly affected organ: lung
- 2nd most common affected organ is the lymph node

Q10.2: What are the various foci of tuberculosis and which organs or anatomical regions do they typically affect?

Answer:

Ghon foci	Lung involvement only.
Ghon complex	Lung and hilar lymph node involvement.
Ranke complex	Lung and hilar lymph node involvement with calcification.
Simon focus	Apex involvement.
Puhl's focus	Supraclavicular region involvement.
Assman focus	Infraclavicular region involvement.
Simmond focus	Liver involvement.
Weighert's focus	Blood vessel involvement.
Rich's focus	Brain involvement.

Q10.3: What types of samples are collected in pulmonary tuberculosis, and what methods are used for their concentration?

Answer:

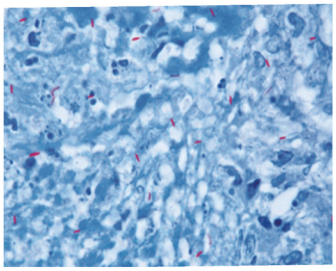
- In the case of pulmonary TB sample taken is Sputum
- Concentration of sample:
  - Modified Petroff method using 4% NaOH
  - Further modification using N-acetyl-L-cysteine with 2% NaOH

Q10.4: What are the microscopic features of Mycobacterium tuberculosis on Ziehl-Neelsen (ZN) staining?

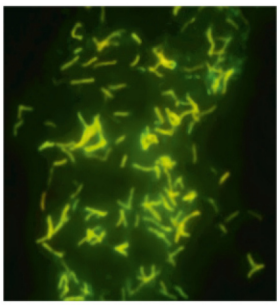
Answer:

PYQ: AIIMS 2021,2022
PYQ: FMGE 2021,2023

- ZN staining shows:
  - Red organisms
  - Blue background
  - Sensitivity: 104 AFB/ml



Q10.5: What are the Fluorescent stains used to detect mycobacterium?



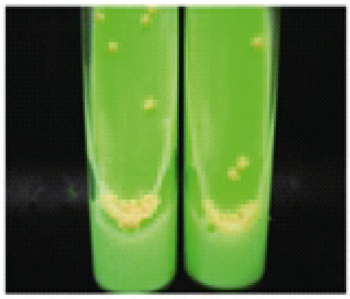
Answer:

- Auramine stain
- Rhodamine stain

Q10.6: What are the components and colony morphology of Lowenstein-Jensen (LJ) medium?

PYQ: FMGE 2022

Answer:



- Lowenstein-Jensen medium is used to culture **Mycobacterium tuberculosis**
  - Rough, buff, and tough colonies
  - 6-8 weeks to grow
  - Sensitivity: 10-100 AFB/ml
  - Composition
    - → Coagulated hen's egg
    - → Mineral salt solution
    - → Asparagine
    - → Malachite green

Q10.7: What are the key differences between Mycobacterium tuberculosis & Mycobacterium bovis?

Answer:

	M. tuberculosis	M. bovis
Niacin	Positive	Negative
Nitrate reduction	Positive	Negative
Catalase	Positive	Negative
Colony	Rough, buff, and tough.	Smooth, white, and breaks easily.

Q10.8: What are some newer automated methods for detecting Mycobacterium tuberculosis and what principles do they use?

Answer:

- Bactec mycobacterium growth indicator tube (MGIT)
  - Middlebrook 7H9 broth
  - Fluorescent-based method
- BacT/alert
  - Colorimetry-based method
- Versatrek
  - Detects pressure changes



Q10.9: What are the commonly used typing methods for Mycobacterium tuberculosis, and what are the features of Gene Xpert?

Answer:

- RFLP

- Target sequence/strain
- **IS6110** strain commonly used

- Gene Xpert
  - Cartridge-based nucleic acid amplification test (CBNAAT)
  - Turn around time of 2 hours
  - Advantages
    - → Detection limit: 131 organisms/ml
    - → Helps in Diagnosis
    - → Resistance to Rifampicin (rpoB gene)



PYQ: AIIMS 2020

PYQ: NEET PG 2018

PYQ: FMGE 2020

- Line probe assay

Q10.10: What are the two diagnostic methods employed to diagnose latent TB?

Answer:

- Mantoux test
- IGRA

Q10.11: What is Mantoux test and how is it interpreted?

Answer:

- Type **IV hypersensitivity** or cell-mediated hypersensitivity
- 0.1 ml of purified protein derivative is given intradermally
- Induration is checked after 48-72 hours
  - >10mm-Positive
  - <5mm-Negative
  - 5-9mm-Equivocal
- Interpretation
  - Positive: Present or past infection
  - False positive: BCG vaccination and non-TB mycobacterium
  - False negative: HIV or immunodeficient states



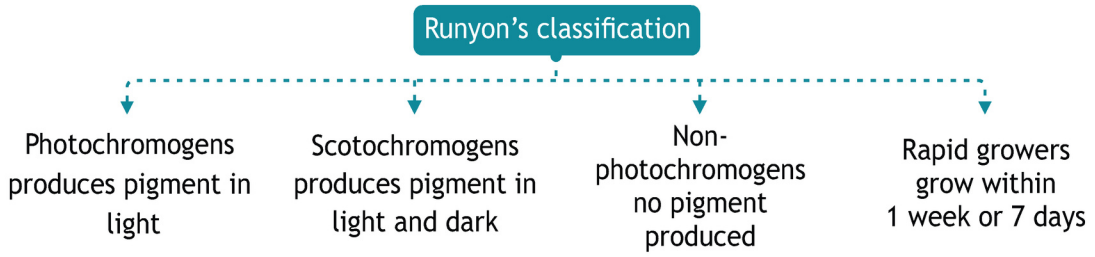
Q10.12: What is IGRA and how is it performed?

Answer:

- Interferon-gamma release assay
- Sample: T-lymphocytes of suspected individuals
- Procedure:
  - T-lymphocytes exposed to CFP 10, TB7.7, and ESAT6
  - Stimulate release of IFN-γ
  - IFN-γ values measured by ELISA

Q10.13: What are the different groups in Runyon's classification of non-tuberculous mycobacteria?

Answer:



YOURWISH

Q10.14: What are photochromogens, and what organisms are included in this group?

Answer:

- Photochromogens produce pigment in light only
- Organisms include: (Mnemonic: MASK)
  - o M. marinum
    - → Swimming pool or fish tank granuloma
    - → Warty skin lesion
  - o M. asiaticum
  - o M. simiae
  - o M. kansasii

Q10.15: What are scotochromogens, and which species fall under this category? PYQ: AIIMS 2019

Answer:

- Scotochromogens produce pigment in light and dark states
- Organisms include: (Mnemonic: God save dark)
  - o M. szulgai
  - o M. scrofulaceum
  - o M. gordonae
    - → Tap water scotochromogens

Q10.16: Which organisms classified under non-photochromogens?

Answer:

- M. avium
- M. intracellulare (battey bacillus)
- M. ulcerans
  - o Buruli ulcer
  - o Mycolactone exotoxin is produced
- M. xenopi
- M. indicus pranii

Q10.17: What are rapid growers, and what organisms are included in this group?

Answer:

- Grow within 7 days
- Organisms include:
  - o M. fortuitum
  - o M. smegmatis
  - o M. chelonae
    - → Associated with Post-surgery abscess
  - o M. phlei

Q10.18: What organisms make up the Mycobacterium avium complex, and what are the associated condition?

Answer:

- Mycobacterium avium complex (MAC)
  - o M. avium
  - o M. intracellulare
- Associated condition: Lady Windermere syndrome.

YOURWISH

YOURWISH

Q10.19: Which Mycobacterium is used for making vaccine for Leprosy?

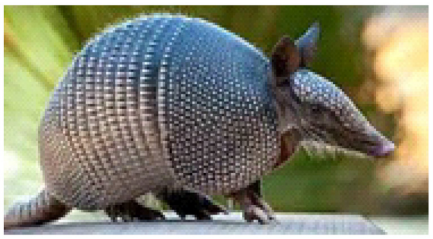
Answer:

- M. indicus pranii is used as an Immunomodulator for making MW vaccine for leprosy.

Q10.20: Write briefly about Mycobacterium leprae.

PYQ: FMGE 2022

Answer:



- Hansen's bacillus
- Obligate intracellular
  - Cannot be grown on any culture medium
  - Grown on a 9-banded armadillo or footpad of mice

3. BACTERIOLOGY PART -2

BIG QUESTION 1: How are gram-negative bacilli of the Enterobacteriaceae family classified and identified based on physical, biochemical, and media characteristics?

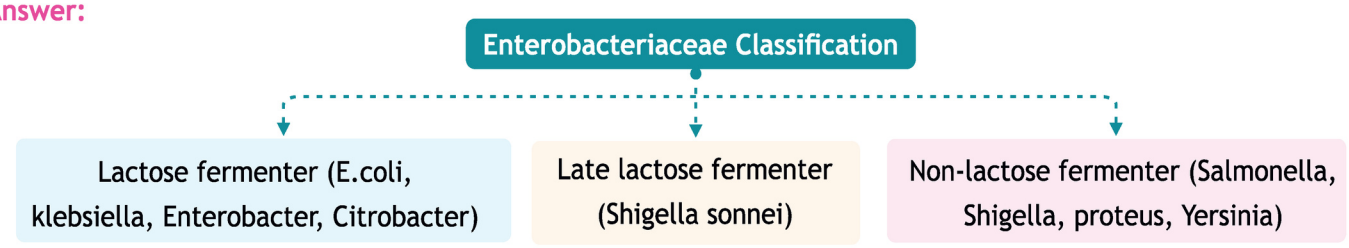
Broad Answer: Enterobacteriaceae is a large family of Gram-negative, facultatively anaerobic bacteria commonly found in the intestinal tracts of humans and animals. They include many important pathogens such as Escherichia coli, Salmonella, and Klebsiella, responsible for various infections.

Member	Motility	LF/NLF	IMViC	Urease
E.Coli	M	LF	++- -	-ve
Klebsiella	NM	LF	-- + +	+ve
Enterobacter	M	LF	v	-ve
Citrobacter	M	LF	v	-ve
Shigella	NM	NLF	-+--	-ve
Salmonella	M/NM (gallinarum, pullorum)	NLF	-+-+	-ve
Proteus	M	NLF	v	+ve
Yersinia	M/NM	NLF	-+--	-ve

DETAILED QUESTIONS

Q1.1: Which members of Enterobacteriaceae are lactose fermenters and which are non-lactose fermenters?

Answer:



Q1.2: What is the IMViC test, and how are its results interpreted in bacterial identification?

Answer:



IMViC:

I- Indole

M - Methyl Red

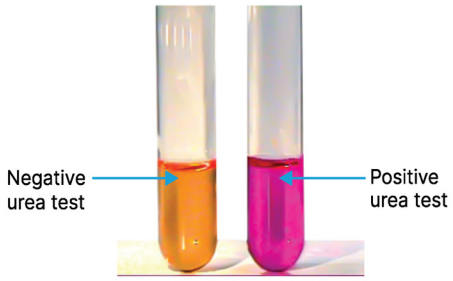
V - VP

C - Citrate

- If the result is positive for IMV, the color is red.
- If the result is positive for citrate, the color is blue.
  - ++-- indicates E.coli
  - --++ indicates Klebsiella

Q1.3: What are the important urease-producing bacteria?

Answer:



- Mnemonic: PUNCH KiSS
  - Proteus
  - Ureaplasma
  - Nocardia
  - Cryptococcus
  - Helicobacter
  - Klebsiella
  - Staph saprophyticus
  - Staph epidermidis

Q1.4: Which coagulase-negative staphylococci are urease positive?

Answer:

- Staph. saprophyticus
- Staph. epidermidis

Q1.5: What are the features of MacConkey agar and how does it differentiate lactose fermenters?

Answer:



- Contains: (mnemonic: PLANT):
  - P - Peptone
  - L - Lactose (differential media)
  - A - Agar
  - N - Neutral red (indicator)
  - T - Taurocholate (bile salts, selective)
- Pink colonies signify lactose fermenters

Q1.6: What is CLED media and what does it detect?

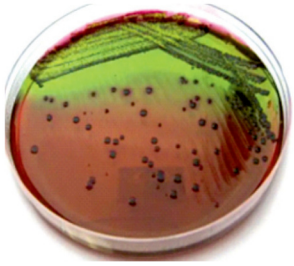
Answer:



- CLED: Cysteine Lactose Electrolyte Deficient media
- Indicator: Bromothymol Blue (BTB)
- Grows both gram-positive and gram-negative organisms
  - Preferred over MacConkey agar for the diagnosis of UTI

Q1.7: What is EMB agar and how does E. coli appear on it?

Answer:



- EMB: Eosin Methylene Blue
- E. coli shows blue-black colonies with green metallic sheen

BIG QUESTION 2: What are the different strains of Escherichia coli, the diseases they cause, and their distinguishing features?

Broad Answer: Pathogenic E. coli is classified into six major strains based on their virulence mechanisms:

- EPEC (Entero Pathogenic EC)
- ETEC (Enterotoxigenic EC)
- EIEC (Entero Invasive EC)
- EHEC (Entero Hemorrhagic EC)
- EAEC (Entero Aggregative EC)
- DAEC (Diffuse Adherent EC)

These strains cause various forms of diarrheal diseases ranging from infantile diarrhea to hemorrhagic colitis and hemolytic uremic syndrome (HUS).

DETAILED QUESTIONS

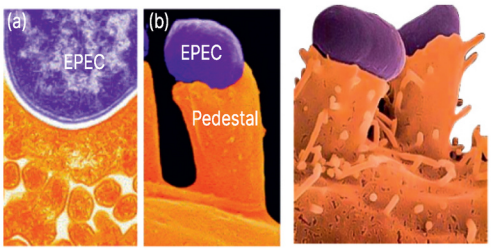
PYQ: NEET PG 2019, 2020

PYQ: AIIMS 2018, 2021

Q2.1: What is the disease caused by EPEC and what is its unique feature?

Answer:

- EPEC (Enteropathogenic E. coli) causes **pediatric/infantile diarrhea**
- Characteristic: Bundle-forming pili (plasmid-coded) and attachment/effacement lesions with pedestal formation



Q2.2: What type of diarrhea does ETEC cause and how is it mediated?

Answer:

- ETEC (Enterotoxigenic E. coli) causes **traveler's diarrhea**
- Toxigenicity due to **Colonization factor Ag**

Q2.3: Which E. coli strain causes dysentery, and what diagnostic test is used?

Answer:

- EIEC (Enteroinvasive E. coli) causes dysentery, clinically similar to Shigella
- Virulence marker antigen is responsible for the disease.
- Diagnostic test: Sereny test
  - Inoculation of bacteria into guinea pig's eye
  - Severe mucopurulent conjunctivitis and severe keratitis indicate a positive test
- It is also done for: Shigella & Listeria (Anton Test)

Q2.4: What are the features of EHEC and which strain is classically associated with HUS?

Answer:

- EHEC (Enterohemorrhagic E. coli) causes HUS (Hemolytic Uremic Syndrome)
- Strain: O157:H7
- Sorbitol MacConkey Agar: Negative (O157:H7)
  - All the other E coli are sorbitol fermenters (Pink colonies).

Q2.5: Which strain of E. coli causes persistent diarrhea, and what is its cellular appearance?

Answer:

- EAEC (Enteroaggregative E. coli) causes persistent diarrhea (>14 days)
- Appearance: Stacked-brick pattern on HEP-2 cell line

Q2.6: What is DAEC and what is its adherence pattern?

Answer:

- DAEC (Diffuse Adherent E. coli)
- Feature: Shows diffuse adherence to epithelial cells

Q2.7: What is the Kass Criteria for diagnosing UTI and what are its exceptions?

Answer:

- Kass Criteria:
  - Significant bacteriuria is defined as the presence of $>10^5$ CFU/mL of a single organism in a clean-catch midstream urine sample
  - This suggests a urinary tract infection
- Exceptions:
  - S - Suprapubic aspiration
  - P - Gram-positive organisms like Staphylococcus aureus and Candida
  - A - Antibiotic or diuretic use

BIG QUESTION 3: What are the types of Klebsiella species, their associated diseases, and key diagnostic features?

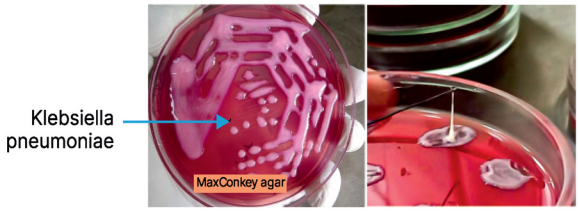
Broad Answer: Klebsiella species include K. pneumoniae, K. ozaenae, K. rhinoscleromatis, and K. granulomatis. These bacteria are gram-negative, capsulated, and often show a mucoid colony. Each type is associated with distinct diseases, affecting the respiratory tract, nasal mucosa, and genitals.

DETAILED QUESTIONS

Q3.1: What are the clinical features and lab findings of Klebsiella pneumoniae?

Answer:

- Also known as Friedländer's bacillus
- Causes pneumonia
- Lactose fementer - pretty pink colour on McConkey Agar
- Capsulated: Show mucoid colonies
- String test positive



Growth of klebsiella pnuemoniae on macConkey agar and string test positive

Q3.2: What disease is caused by Klebsiella ozaenae, and what are its clinical features?

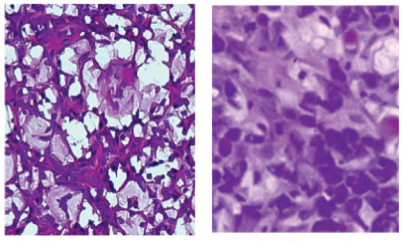
Answer:

- Causes ozena/atrophic rhinitis
- Symptoms:
  - Foul-smelling nasal discharge
  - Anosmia

Q3.3: What is the clinical significance of Klebsiella rhinoscleromatis?

Answer:

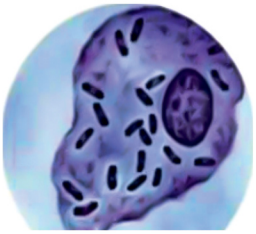
- Causes rhinoscleroma
- Nose appears woody
- Histopathology:
  - **Mikulicz cells** (large foamy macrophages)
  - **Russell bodies** (eosinophilic inclusions inside Mikulicz cells)


Mikulicz cell and russel body in rhinoscleroma

Q3.4: What are the key features of Klebsiella granulomatis infection?

Answer:

- Causes Donovanosis
  - o Painless genital ulcer
- Microscopy:
  - o Donovan bodies with safety pin appearance (bipolar staining)
- Stains: Wright-Giemsa or Wayson stain



Donovan body showing safety pin appearance.

Q3.5: Which organisms show a safety pin appearance on staining?

Answer:

- Vibrio parahaemolyticus
- Yersinia pestis
- Haemophilus ducreyi
- Burkholderia
- Klebsiella granulomatis

BIG QUESTION 4: What are the distinguishing features, clinical relevance, and diagnostic tests for Serratia marcescens, Proteus, and Shigella species?

Broad Answer: Serratia marcescens, Proteus, and Shigella are gram-negative bacilli with distinct biochemical and clinical features. Serratia produces a red pigment and may mimic hemoptysis, Proteus is known for swarming motility and urease production, while Shigella species vary in biochemical reactions and are major causes of dysentery.

DETAILED QUESTIONS

Q4.1: What are the unique features of Serratia marcescens?

Answer:

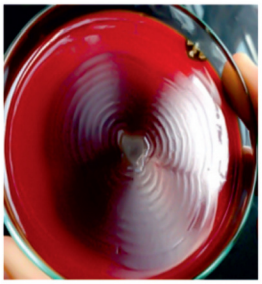
- Produces a non-diffusible red pigment called **prodigiosin** at room temperature
- Can cause pseudohemoptysis (false appearance of blood in sputum)
- Used as a control for filtration systems in lab environments

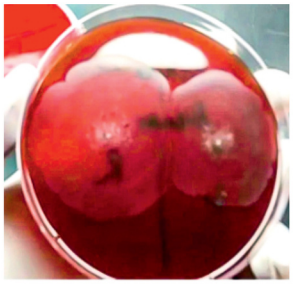


Q4.2: What are the key features and tests for identifying Proteus species?

Answer:

- Urease positive
- Characteristic swarming motility (concentric growth)
- Swarming motility is seen in :
  - o Mnemonic: PVCS (Proteus, Vibrio parahemolyticus, Clostridium tetani, Serratia)
- PPA test positive
- Fishy odor
- Dienes phenomenon:happens when more than 1 organism is growing in a media
  - o Used for epidemiological typing
  - o If swarms merge → same strain
  - o If swarms show demarcation line → different strains





Note: It is different from Diene's stain (used for mycoplasma)

Q4.3: What are the main types of Shigella and how do they differ?

Answer:

- S. dysenteriae:
  - Only catalase negative and non-mannitol fermenter
- S. flexneri:
  - Most common in India
- S. boydii
- S. sonnei:
  - Most common globally
  - Late lactose fermenter

Q4.4: What is the enrichment media, selective media & transport medium for Shigellosis?

Answer:

Enrichment Media	Selective Media
• Selenite F Broth • Tetrathionate Broth	• XLS (xylose lysine deoxycholate) • DCA (deoxycholate agar) • SS (salmonella shigella agar) • HE (Hektoen enteric agar)

- Transport medium: Sach's Buffered Glycerol Saline (SBGS)

Q4.5: What is the treatment of choice for shigellosis?

Answer

- Ciprofloxacin

BIG QUESTION 5: What are the clinical features, diagnostic methods, and laboratory findings in Salmonella infections?

Broad Answer: Salmonella typhi causes enteric (typhoid) fever, characterized by a step-ladder fever pattern, bradycardia, rose spots, and GI symptoms like pea-soup diarrhea. Diagnosis involves blood culture, Widal test, antigen identification, and use of selective/enrichment media. Treatment includes ciprofloxacin, and vaccines are available. Understanding the timing of culture positivity and antigen differences between S. typhi and paratyphi strains is crucial for diagnosis.

DETAILED QUESTIONS

Q5.1: What are the classic clinical features of Salmonella typhi infection?

Answer: Causes enteric fever

- Step-ladder pattern fever
- Pea-soup diarrhea
- Bradycardia with fever (**Faget's sign**)
- Soft, palpable spleen and liver
- Rose spots on the trunk (2nd-3rd week, fade on pressure)
- Longitudinal ulcers in the gastrointestinal tract

Q5.2: What is the transport medium and treatment of choice for Typhoid?

Answer:

- Transport medium: Sach's Buffered Glycerol Saline (SBGS)
- Treatment of choice: Ciprofloxacin

Q5.3: What is Wilson and Blair medium used for, and what are the colony features?

Answer:

- Selective medium for S. typhi
- Produces jet black colonies due to H_2S production
- Not used for Shigella



Q5.4: What are the antigens in Typhoid and their diagnostic significance in Widal test?

Answer:

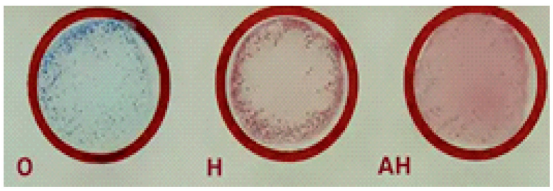
- S. typhi has O (somatic) and H (flagellar) antigens
  - O antigen is shared by S. typhi, S. paratyphi A, and B
  - H antigen is different for each

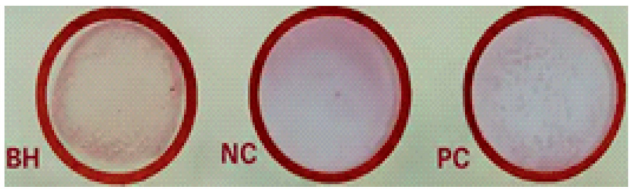
Widal Test

PYQ: FMGE 2018, 2019, 2022

	T_O	T_H	A_H	B_H
S.Typhi	+	+	-	-
S. paratyphi A	+	-	+	-
S. paratyphi B	+	-	-	+
Early	+	-	-	-
Late	-	+	-	-
Vaccine (V_i)	-	+	+	+

- O antibody: appears first, disappears first
- H antibody: appears second, disappears last
- H antigen is the most immunogenic, appearing earliest and at the highest titer.
- Slide Widal test:
  - A dot indicates agglutination
  - Requires serial testing due to non-specificity





Q5.5: What are new diagnostic tests for Typhoid?

Answer:

- Typhidot
- Dot blot test

YOURWISH

Q5.6: What are the enrichment and selective media used in Salmonella diagnosis?

Answer:

- Enrichment Media:
  - Selenite F broth
  - Tetrathionate broth
- Selective Media:
  - XLD (Xylose Lysine Deoxycholate agar)
  - DCA (Deoxycholate Citrate agar)
  - SS (Salmonella-Shigella agar)
  - HE (Hektoen Enteric agar)
  - Wilson and Blair medium (best for S. typhi)
    - → Produces jet black colonies
    - → Not used for Shigella

Q5.7: What is the weekly pattern of culture and test positivity in Typhoid fever?

Answer:

Week	Positive Test
1	Blood culture
2	Widal (Antibodies)
3	Stool culture
4	Urine culture

BIG QUESTION 6: What are the key features, types, and diagnostic methods of Yersinia species including Y. pestis, Y. enterocolitica, and Y. pseudotuberculosis?

Broad Answer:

Yersinia is a genus in the Enterobacteriaceae family. It includes Y. pestis, the causative agent of plague, and Y. enterocolitica and Y. pseudotuberculosis, which cause yersiniosis. Laboratory identification relies on temperature-based motility, urease testing, special stains, and specific media like CIN agar.

DETAILED QUESTIONS

Q6.1: What diseases are caused by different Yersinia species?

Answer:

- Yersinia pestis: Causes plague (bubonic, pneumonic, septicemic)
- Y. enterocolitica & Y. pseudotuberculosis: Cause yersiniosis (gastroenteritis)

Q6.2: What are the clinical types of plague and their features?

Answer:

- Bubonic plague:
  - Incubation: 2-7 days
  - Painful lymph node enlargement (buboes) and fever
- Pneumonic plague:
  - Incubation: 1-3 days

- Respiratory symptoms
- High concern for bioterrorism

- Septicemic plague:
  - May follow bubonic or pneumonic
  - Associated with Black Death

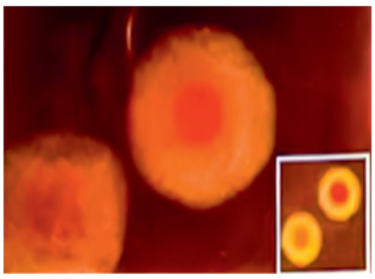
Q6.3: What are the physical and biochemical features of Yersinia species?

Answer:

Features	Yersinia Pestis	Yersinia Enterocolitica	Yersinia Pseudotuberculosis
Motile at 22°	Negative	• 22° (motile) • 37° (non-motile) • Also known as differential motility	
Urease	Negative	Positive	

Q6.4: How is yersiniosis diagnosed in the lab?

Answer:



- Cold enrichment technique
- Optimal growth temperature: 25°C
- Incubate at 4°C for 1 week: improves isolation
- CIN agar: Shows **bull's eye** appearance
  - Seen in both yersiniosis and listeriosis

Q6.5: What are the diagnostic samples and stains used for Y. pestis?

Answer:



- Samples: Stool, sputum, or bubo aspirate
- Microscopy:
  - Shows safety pin appearance
- Stains: Wayson stain (NMB), Wright stain, or Giemsa stain
- Ghee broth: Shows stalactite growth

BIG QUESTION 7: What are the key characteristics, classification, diagnostic features, and clinical relevance of Vibrio species?

Broad Answer: Vibrio species are gram-negative, comma-shaped, oxidase-positive bacilli with darting motility. They are classified as halophilic or non-halophilic, and cause diseases like cholera, gastroenteritis, wound infections, and sepsis. Diagnostic tests include TCBS culture, string test, and biochemical tests.

DETAILED QUESTIONS

Q7.1: How are Vibrio species classified based on salt requirement?

Answer:

Halophilic Vibrio (Require 7-10% NaCl)	Non-Halophilic Vibrio (Do not tolerate high salt)
V. parahaemolyticus	V. cholerae
V. alginolyticus	V. mimicus
V. vulnificus	

Q7.2: What are the distinguishing features between classical and El Tor strains of V. cholerae? PYQ: FMGE 2021

Answer:

Feature	Classical Strain	El Tor Strain
Polymyxin B sensitivity	Sensitive	Resistant
Phage IV susceptibility	Susceptible	Resistant
β-hemolysis on sheep blood agar	Negative	Positive
Chick erythrocyte agglutination	Negative	Positive
VP test	Negative	Positive

Q7.3: What is the mechanism and clinical presentation of V. cholerae infection?

Answer:

- Targets small intestine
- Toxin increases cAMP, leading to watery diarrhea (rice-water stools)
- Disrupts zona occludens (tight junctions)

Q7.4: Which organisms increase cAMP and cGMP levels, and what are the associated toxins?

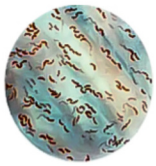
Answer:

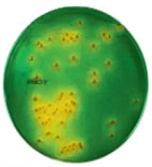
Molecule	Organism & Toxin
↑ cAMP	V. cholerae, ETEC (labile toxin), Anthrax, Pertussis, B. cereus (diarrheal type food poisoning)
↑ cGMP	ETEC (stable toxin), B. cereus (emetic type food poisoning)

Q7.5: What is the diagnostic approach for V. cholerae?

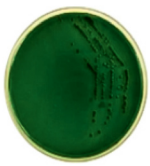
Answer:

- Sample: Stool
- Transport media: VR medium, Cary-Blair medium
- Culture media: TCBS (Thiosulfate Citrate Bile Salt Sucrose)
  - Indicator: Bromothymol Blue (BTB)
- Motility: Darting/shooting star motility (also seen in Campylobacter)
- Gelatin stab: Turnip/Napiform liquefaction





Vibrio cholerae on TCBS agar Sucrose Fermenter



Vibrio pharahaemolyticus on TCBS Agar Non Sucrose Fermenter

Q7.6: What are the biochemical features of Vibrio cholerae?

Answer: (Mnemonic: CCOINSS)

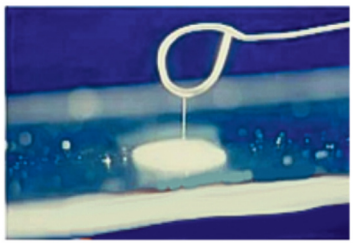
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Test	Result
C - Catalase	Positive
C - Cholera red reaction (nitroso indole compound)	Positive
O - Oxidase	Positive
I - Indole	Positive
N - Nitrate reduction	Positive
S - Sucrose lysis	Positive
S - String test	Positive

Q7.7: What is the significance of a positive string test and which organisms show it?

Answer:

- Occurs when the vibrio is mixed with bile salts
- Positive in:
  - o Vibrio cholerae
  - o Klebsiella (due to mucopolysaccharide capsule)
  - o Giardia lamblia



Positive String Test

Q7.8: What are the clinical features and special diagnostics for halophilic Vibrio species?

Answer:

Species	Clinical Features
V. parahaemolyticus	• Gastroenteritis • Wound Infection • Kanagawa phenomenon (Wagatsuma agar: blood agar + 2-4% salt) o Only pathogenic bacteria shows hemolysis
V. vulnificus	• Wound infection • Sepsis
V. alginolyticus	• Wound infection • Conjunctivitis • Most salt-tolerant (>10%)

Q7.9: Which organisms are oxidase positive?

Answer:

- Mnemonic: PVNCH
- Pseudomonas
- Vibrio cholera
- Neisseria
- Campylobacter
- Helicobacter

BIG QUESTION 8: What are the key characteristics, pigments, clinical associations, and antibiotic resistance profiles of non-fermenting gram-negative bacilli?

YOURWISH

Broad Answer: Non-fermenters like Pseudomonas, Burkholderia, and Acinetobacter do not ferment sugars and are associated with serious nosocomial infections and multidrug resistance (MDR). Pseudomonas aeruginosa is known for pigment production and distinctive odours. Burkholderia species cause diseases ranging from glanders to melioidosis and are noted for their antibiotic resistance and role in bioterrorism.

DETAILED QUESTIONS

Q8.1: Which bacteria are classified as non-fermenters, and what is their defining feature?

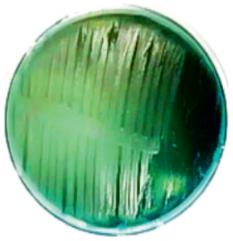
Answer:

- Does not ferment sugars do not ferment sugars
- Includes:
  - Pseudomonas aeruginosa
  - Burkholderia mallei
  - Burkholderia pseudomallei
  - Acinetobacter baumannii

Q8.2: What pigments are produced by Pseudomonas aeruginosa and on which media are they enhanced?

Answer: PYQ: NEET PG 2021 PYQ: AIIMS 2023

Pigment	Color
Pyocyanin	Blue-green (diffusible)
Pyoverdin	Green-yellow
Pyorubin	Red
Pyomelanin	Black



Pyocyanin – Blue Green Pigment

- King's media enhances pigment production

Q8.3: What are the clinical conditions caused by Pseudomonas aeruginosa?

Answer:



Green Nail syndrome

- Pneumonia
- Otitis externa (Swimmer's ear)
- Hot tub folliculitis (Jacuzzi fever syndrome)
- Contact lens-associated corneal ulcers
- Shanghai fever
- Meningitis
- UTI
- Burn wound infections
- Green nail syndrome

Q8.4: What are the lab features and diagnostic characteristics of Pseudomonas?

Answer:

- Sweet fruity odor
- Iridescence (colonies with metallic shine)

- Use sugar
- Oxidation
- Motile
- NLF
- Agar - B hemolytic
- Selective Cetrimide agar

Q8.5: What organisms are included in the WHO ESKAPE group of MDR nosocomial pathogens?

Answer:

Mnemonic - ESKAPE

- E: Enterococcus faecium
- S: Staphylococcus aureus
- K: Klebsiella pneumoniae
- A: Acinetobacter baumannii
- P: Pseudomonas aeruginosa
- E: Enterobacter species

Q8.6: What are the distinguishing features of Burkholderia cepacia?

Answer:

PYQ: NEET PG 2018 PYQ: FMGE 2021

- Most common and most antibiotic-resistant among Burkholderia
- Associated with chronic granulomatous disease and cystic fibrosis
- Most potent

Q8.7: What are the key facts about Burkholderia mallei?

Answer:

- Causes Glanders disease in animals
- Diagnosis: Strauss reaction
  - Inoculation in guinea pigs
  - Testicular swelling
- Clinical features:
  - Skin ulcer
  - Pneumonia
  - Scrotal swelling

Q8.8: What is Burkholderia pseudomallei and what are its features?

Answer:

- Causes Melioidosis/Vietnam time bomb/ Whitmore bacillus
- Culture: ASA (Ashdown agar)
- Microscopy: Safety pin appearance
- Associated with bioterrorism
- Treatment: Carbapenems, e.g., imipenem

BIG QUESTION 9: What are the clinical features, diagnosis, and treatment approaches for Haemophilus, Bordetella, and Brucella (HBB group)?

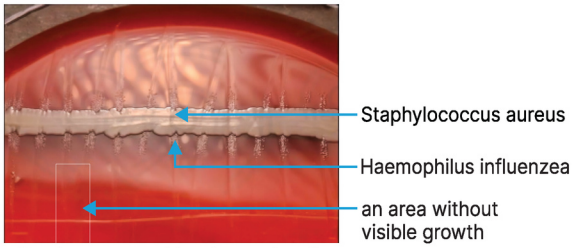
Broad Answer: The HBB organisms—Haemophilus, Bordetella pertussis, and Brucella—are fastidious gram-negative bacteria that cause respiratory and zoonotic infections. Their identification depends on specific growth factors, media, antigen detection, and serology. Each has distinctive features, virulence mechanisms (like pertussis toxin or PRP capsule), and vaccine or antibiotic strategies for control.

DETAILED QUESTIONS

Q9.1: What are the clinical and diagnostic features of Haemophilus influenzae?

Answer:

- AKA Pfeiffer bacillus
- Virulence factors: Capsular polysaccharide.
- Capsular types A-F, with type B (Hib) most virulent
- Diseases:
  - Meningitis
  - Pneumonia
  - Croup [laryngotracheobronchitis]
  - Suppurative infections
- Vaccine: Hib vaccine (PRP-polyribosylribitol phosphate)
- Drug of choice: Cefotaxime or Ceftriaxone
- Satellite phenomenon:
  - Requires Factor V (NAD) and Factor X (hemin)
  - Grows around Staph. aureus on blood agar, which lyses RBCs and provides V & X factors



Staph aureus on blood agar showing narrow zone of hemolysis

Q9.2: Which Haemophilus species require which factors to grow?

Answer:

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

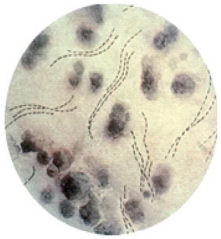
Q9.3: What are the features of Haemophilus ducreyi?

PYQ: NEET PG 2020 PYQ: AIIMS 2023

Answer:

- Disease: Chancroid (painful genital ulcer) - soft sore
  - In syphilis- hard painless chancre
- Media: Chocolate agar + Isovitalex + fetal calf serum

- School of fish appearance
- Treatment: Azithromycin



H. ducreyi - school of fish appearance

Q9.4: What are the stages and features of Bordetella pertussis infection?

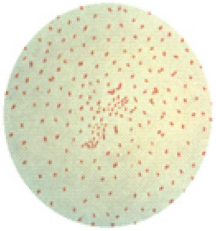
Answer:

Stage	Features
Catarrhal	Dry cough, fever, most infectious
Paroxysmal	Whooping cough (inspiratory whoop)
Convalescent	Gradual recovery

- Also known as 100-day cough
- Toxin: Pertussis toxin → ↑ cAMP
- Vaccine: Acellular (contains FHA, PT, AGG, PERT)
- Drug of choice: Erythromycin or Azithromycin
- Bisected pearls/mercury drops
- Aluminum paint appearance (confluent)
- M/E: thumb print appearance
- Bordet - Gengou medium



Mercury drop/bissected pearls



Thumb print appearance

Q9.5: What are the features, presentations, diagnosis and treatment of brucella?

Answer:

- Zoonotic disease
- Enzyme profile: Catalase +, Oxidase +, Urease +
- Triad:
  - Night sweats
  - Arthritis
  - Hepatosplenomegaly
- Diagnosis:
  - Standard agglutination test → Detects IgG & IgM
  - 2-mercaptoethanol test: Destroys IgM
  - Milk ring test: Animal screening
- Treatment:
  - Doxycycline (45 days)
  - Streptomycin IM for 14 days

Q9.6: Which organisms do not stain well with Gram stain?

Answer: (Mnemonic: MRCS)

- M: Mycoplasma
- R: Rickettsia

YOURWISH

- C: Chlamydia
- S: Spirochetes

BIG QUESTION 10: What are the characteristics, diagnosis, and stages of diseases caused by spirochetes, especially Treponema pallidum?

Broad Answer: Spirochetes are spiral-shaped, motile bacteria including Treponema, Borrelia, and Leptospira. Treponema pallidum causes syphilis, which progresses through primary, secondary, and tertiary stages. Diagnosis includes dark-field microscopy, silver stains, non-specific serologic tests like VDRL/RPR, and specific treponemal tests like FTA-ABS. Treatment is typically benzathine penicillin.

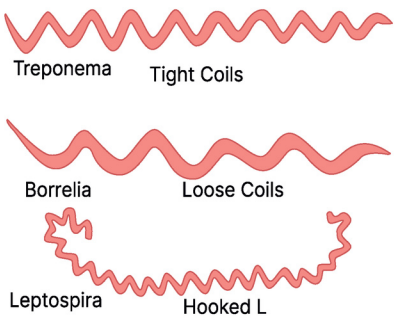
DETAILED QUESTIONS

Q10.1: What are the key morphologic and motility differences between spirochete species?

Answer:

PYQ: FMGE 2018, 2020

Spirochete	Coil Type	Motility Type	Shape Detail
Treponema	Tight coils	Corkscrew movement	Smooth spiral
Borrelia	Loose spirals	Lashing movement	Irregular spirals
Leptospira	Hooked ends	Rapid, flexing	Hooked, "L" ends



Q10.2: What are the clinical stages of syphilis and their features?

Answer:

- Cause: T. pallidium
- Venereal syphilis: STD
- Incubation period: 9 - 90 days

Stage	Features
Primary syphilis	Painless ulcer, painless lymphadenopathy, hard chancre
Secondary syphilis	Condylomata lata, rash (especially palms/soles), mucocutaneous lesions
Tertiary syphilis	Gumma, tree bark aorta, aortic regurgitation, neurosyphilis






Q10.3: What are the nonspecific screening tests for syphilis?

Answer:

- Wasserman test (CFT)
- Kahn test

- VDRL
  - Serum (preheating needed)
  - Cardiolipin Ag (use within 24 hours)
  - Agglutination (slide-based test)
- RPR
  - No fluid prepared
  - Cardiolipin Ag not needed
  - Slide agglutination not needed: card test
- Serological diagnosis:
  - Cardiolipin Antigen
  - Purified lipid extract of beef heart + lecithin + cholesterol
  - Sample: Blood and CSF
  - Investigation of choice for Neurosyphilis



RPR Card

Q10.4: What are the specific confirmatory tests for Treponema pallidum?

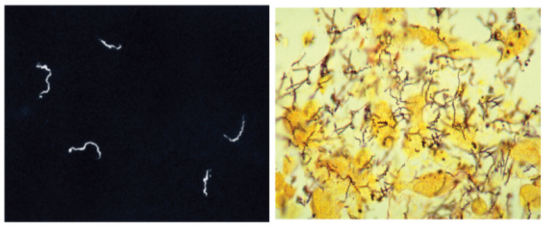
Answer:

Test	Description	
FTA-ABS	Fluorescent Treponemal Ab assay	Most sensitive
TPI	Treponema pallidum Immobilization	Most specific
TPHA	Hemagglutination assay	Specific; widely used
TPPA	Particulate agglutination assay	Alternative to TPHA

Q10.5: How is syphilis diagnosed microscopically?

Answer:

Method		
Dark-field microscopy	Direct visualization of live spirochetes	
Levaditi stain	Tissues	Silver impregnation
Fontana stain	Fluids/films	



Q10.6: What is the incubation period and standard treatment for syphilis?

Answer:

- Incubation: 9-90 days
- Treatment: Benzathine Penicillin

BIG QUESTION 11: What are the key features, diseases, diagnosis, and treatment of Leptospira, Borrelia, Chlamydia, and Rickettsial organisms?

Broad Answer: Spirochetes (Borrelia, Leptospira), Chlamydia, and Rickettsiae are unique pathogens with distinct morphology and intracellular or vector-borne behavior. Spirochetes are motile with helical structures, Chlamydiae are obligate intracellular organisms requiring host ATP, and Rickettsiae are arthropod-borne bacteria producing febrile rash illnesses. Their diagnosis involves specific staining, serological tests, and molecular techniques, while treatment often includes doxycycline or tetracycline.

DETAILED QUESTIONS

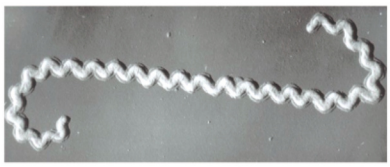
Q11.1: What are the features and diagnosis of Leptospira infection?

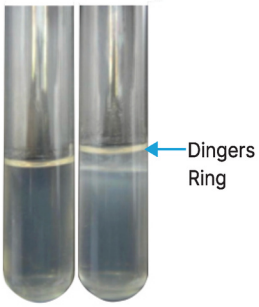
PYQ: NEET PG 2022, 2023

PYQ: AIIMS 2018, 2020

Answer:

- Shape: Spirochete with hooked ends
- Disease: Weil's disease (Ictero-hemorrhagic fever) → jaundice, renal failure
- Transmission: Rat urine, contaminated rain water (e.g., paddy field workers)
- Diagnosis:
  - Best test: Microscopic Agglutination Test (MAT)
  - Dinger's ring





Q11.2: What are the different Borrelia species and their clinical significance?

Answer:

Species	Disease	Vector	Notes
Borrelia burgdorferi	Lyme disease	Ixodid tick (Hard tick)	Target/Bull's-eye rash (Erythema migrans) 
B. recurrentis	Epidemic relapsing fever	Louse	-
B. duttoni	Endemic tick-borne relapsing fever	Tick	• Treatment o Tetracyclines o Chloramphenicol • No vaccine • Collect the blood • Sample during fever
B. vincentii	Vincent's angina (ulcerative gingivitis)	-	Causes ulcerative gingivostomatitis Oropharyngitis

Q11.3: What are the basic features of Chlamydia and its types?

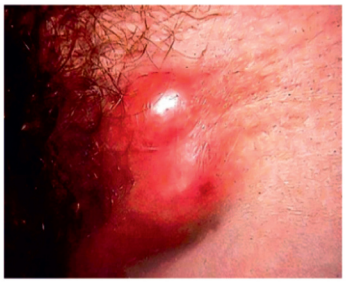
Answer:

- Atypical intracellular bacteria, require host ATP (ATP parasites)
- Basophilic bacterial inclusions
- Cannot be cultured (intracellular)
- No peptidoglycan in the cell wall

- Two forms:
  - o Elementary body (Infectious, DNA = RNA) - Mnemonic: EEEE
  - o Reticulate body (Replicative, RNA > DNA) - Mnemonic: RRR

Q11.4: What are the types of Chlamydia trachomatis, and their associated diseases?

PYQ: AIIMS 2018
PYQ: FMGE 2021

Serotypes	Disease
A, B, Ba, C	• Trachoma • Halberstadter-Prowazeki bodies (HP)
D, E, F, G. H, I, J, K	• NGU • Inclusion conjunctivitis • Neonatal conjunctivitis (Ophthalmia neonatorum) • Fitz-Hugh-Curtis syndrome
L1, L2, L3 	Lymphogranuloma venereum (LGV) Mnemonic (ABCDEFG) • Asymptomatic • Buboes (painful) • Conjunctivitis, Urethritis, Polyarthritis • Doxycycline - treatment • Esthiomene (rectal and vulvar strictures) • Fries test- skin test for LGV • Groove sign • Fitz Hugh Curtis syndrome

Q11.5: What are the diseases caused by C. pneumoniae and C. psittaci?

Answer:

Chlamydia species	Disease Caused
C. pneumoniae	Atypical pneumonia (TWAR strain) Single strain
C. psittaci	Psittacosis (bird-borne respiratory illness) Levinthal Cole Lillie body Several serotypes

Q11.6: What are the Rickettsial diseases and their vectors?

PYQ: NEET PG 2023

Answer:

	Caused by	Arthropods Involved
Epidemic Typhus	R. Prowazekii	Louse
Endemic Typhus	R. Typhi	Flea

YOURWISH

RMSF	R. Rickettsii	Tick
Indian Tick Typhus	R. Conori	Tick
African Tick Typhus	R. Africae	Tick
Rickettsial pox	R. akari	Mite
Scrub Typhus	Orientia tsutsugamushi	Mite

- In all the above cases, rash starts from trunk and then goes to extremities
  - Exception: RMSF:
  - Rash starts from extremities and then goes to trunk

Q11.7: What are the key facts about Rickettsiae, and their diagnostic methods?

Answer:

- Obligate intracellular, arthropod-borne pathogens
- Rash starts on trunk → extremities (except RMSF)
- Do not stain well with Gram stain
  - Use special stains: Giemsa, Macchiavello, Castaneda stains
- Culture: Yolk sac of embryonated eggs or cell lines (Vero, HeLa, Hep2, Detroit 6)

Q11.8: What is the Weil-Felix test and how is it interpreted?

Answer:

- Heterophile agglutination test using Proteus antigens
- Antigen agglutination pattern:

	OX19	OX2	OXK
Epidemic	+++	+	-
Brill Zinsser	-	-	-
Endemic	+++	+/-	-
Spotted	++	++	-
Scrub	-	-	+++

Q11.9: What are features of Scrub Typhus?

Answer:

PYQ: AIIMS 2019, 2020

- Chigger borne disease
- Zoonotic tetrad
  - Transported by trombiculid bites
- Carry infection in rats/squirrel
  - Chiggers/larva - infects humans
  - Present in vegetation or shrubs
- Eschar in moist areas of the body: axilla, groin

Q11.10 What is Neil Mooser reaction, and its interpretation?

Answer: Also known as tunica reaction.

- Procedure:
  - Intraperitoneal inoculation of Guinea pig with blood from the affected case

- Scrotal inflammation: Positive reaction
- R. prowazekii - Negative reaction
- R. Typhi - Positive reaction

Q11.11 What is the vector for Brill Zinsser disease?

Answer:

- Brill Zinsser disease/recrudescent typhus/reactivation typhus has no vector
- Less severe disease
- Associated with Epidemic typhus

Q11.12: How are Rickettsial infections managed?

Answer: Doxycycline or Tetracycline

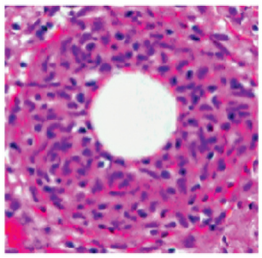
BIG QUESTION 12: What are the key features, clinical relevance, diagnostic methods, and treatments of Coxiella, Mycoplasma, Bartonella, Campylobacter, and Helicobacter species?

Broad Answer: These bacteria include intracellular pathogens (Coxiella burnetii), wall-less organisms (Mycoplasma), zoonotic bacteria (Bartonella), curved motile organisms (Campylobacter, Helicobacter), and each has distinct diagnostic methods and clinical syndromes. Treatments vary by organism, from tetracyclines to macrolides and proton pump inhibitors.

DETAILED QUESTIONS

PYQ: AIIMS 2019





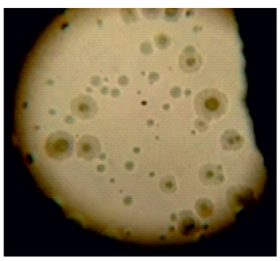
Q12.1: What are the key features of Coxiella burnetii?

Answer:

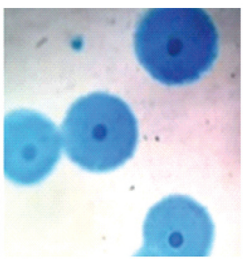
- Organism: Obligate intracellular bacterium
- Transmission: Inhalation (No arthropod vector)
- Disease: Q fever
- Pathognomonic lesion: Doughnut granuloma (fibrin ring granuloma)
  - No rash
  - No Weil-Felix reaction
- Treatment: Tetracycline (DOC)

Q12.2: What are the characteristics and diagnosis of Mycoplasma pneumoniae infection?

Answer:



PPLO agar shows fried egg colonies



Diene's Stain

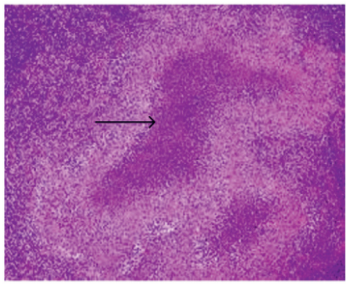
- Also known as Eaton's Agent
- Most common cause: Atypical community acquired pneumonia (walking pneumonia)
- No cell wall, so not visible on Gram stain
- Membrane contains steroids
- Cultured on PPLO agar - shows fried egg colonies, tiny colonies
- Cold agglutination test: Positive (autoantibodies against RBCs)
- Stain: Diene's stain
- Treatment: Macrolides (DOC)

Q12.3: What are the different types of Bartonella species and the diseases they cause?

PYQ: FMGE 2018, 2023

Answer:

Bartonella Bacilliformis	Bartonella Quintana	Bartonella Henselae
• Oroya fever / carrion disease • Vector- sand fly	• 5 day/trench fever • Vector- louse	• **Causes cat scratch disease,** • B. angiomatosis and peliosis



Stellate necrotizing granulomas

- Granulomas: Stellate (LGV and cat scratch)
- Stain: Warthin-Starry silver stain for bacillary angiomatosis

Q12.4: What are the key agglutination tests and their corresponding diseases?

Answer:

- CAT - Cold Agglutination Test → Mycoplasma
- SAT - Standard Agglutination Test → Brucella
- MAT - Microscopic Agglutination Test → Leptospira

Q12.5: What are the features of Campylobacter jejuni?

Answer:

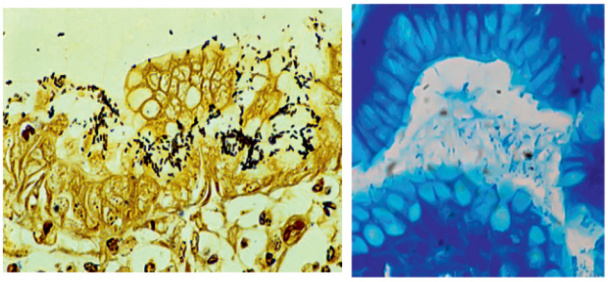


- Comma/spiral/gullwing-shaped, motile
- Thermophilic: Grows best at 42°C
- Incubation period: 1 week
- Culture on: Skirrow agar, Campy BAP, Butzler agar
  - o Droplet-like colonies
  - o Comma/gullwing shaped
- Motility: Shooting star/darting (also in Vibrio)
- Transmission: Ingestion
- Diseases:
  - o Watery or bloody diarrhea
  - o Guillain-Barré Syndrome (GBS)

Q12.6: What are the features, and diseases associated with Helicobacter pylori?

PYQ: NEET PG 2018

Answer:



- Catalase, oxidase & urease positive
- Diseases:
  - o Gastritis
  - o Peptic ulcer disease
  - o MALT lymphoma
  - o Gastric adenocarcinoma
    - → MALToma and adenocarcinoma is due to cag A and vac A
- Stains:
  - o Warthin-Starry stain - black appearance
  - o Modified Giemsa stain

YOURWISH

Q12.7: What are the toxins that act by inhibiting protein synthesis?

Answer: Toxins that decrease protein synthesis (Mnemonic: DPSS)

- Diphtheria toxin.
- Exotoxin A of pseudomonas.
- Shiga toxin - Shigella.
- Shiga-like toxin/Verocytotoxin - E. coli.

Mechanisms

- Diphtheria toxin and exotoxin A of pseudomonas cause **ADP ribosylation of Elongation Factor-2 (Ef2).**
- Shiga and Shiga-like toxins inhibit 60S ribosomes.

Q12.8: Which toxins act by increasing cAMP and cGMP?

Answer: Toxins that act by increasing cAMP and cGMP

- Cyclic AMP
  - Cholera
  - Anthrax
  - ETEC (labile toxin)
  - Pertussis
- Cyclic GMP
  - ETEC(stable toxin)
  - Bacillus cereus (emesis)

Q12.9: What is toxic shock syndrome?

Answer:

- TSS
  - S.aureus
  - TSST/Enterotoxin F - fatal female disease (tampons)

Q12.10: Which toxin is responsible for tetanus?

Answer:

- Tetanus
  - Tetanolysin
  - Tetanospasmin- causes tetanus

Q12.11: What are the culture media used for S. aureus?

Answer: selected area

Organism	Culture media
Staphylococcus (mnemonic: SAMO SA) • Mannitol fermentation • Color = Yellow	• Mannitol Salt Agar • Ludlam's Salt Agar o Indicator = Phenol Red

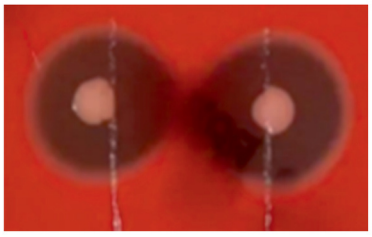


Staphylococcus aureus mannitol fermenter

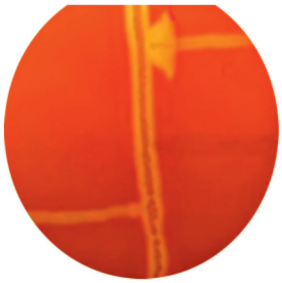


Staphylococcus epidermidis non mannitol fermenter

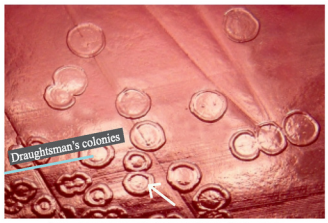
YOURWISH

Streptococcus pyogenes Transport media = Pike's media	 • Pin point colonies o Wide zone of hemolysis Selective media • PNF media • Crystal violet blood agar • Liquid media = granular

Q12.12: What are the culture media used for Streptococcus pyogenes?
Answer: All the information under the selected heading

Streptococcus agalactaie GALA - CAMP	 CAMP Test

Q12.13: What is CAMP test?
Answer: selected area

Streptococcus Pneumonia	 Draughtsmann/carrom Coin Colonies

Q12.14: What is the colony morphology of Pneumococcus?
Answer: Draughtsmann/carrom coin colonies

Enterococcus	• Bile Esculin Azide (BEA) agar Color = Black 

Q12.15: Which streptococci shows esculin positivity?
Answer: Content under the selected heading

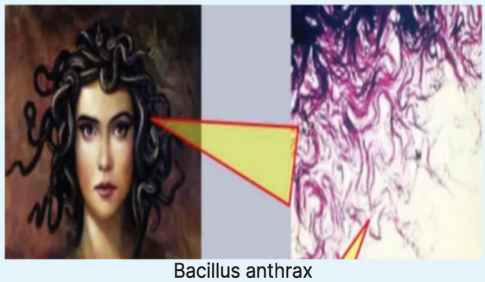
Neisseria (M + G) • Transport Media = AMIES/Stuart Media	• Modified taayer martin media • New york city agar

Q12.16: What are the different media used for diagnosis of Neisseria infections?
Answer: Selected area

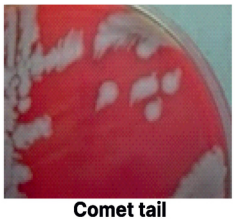
Corynebacterium Diphtheria	• Enriched: Loefler serum slope = 8 hours • Selective: potassium Teccurite agar/Tinsdale agar = 48 hours

Q12.17: What are the culture media used for corynebacterial infection?
Answer: Selected area

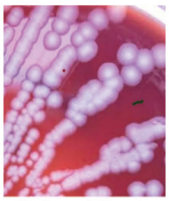
- Blood agar
- Selective Media: PLET media


Bacillus anthrax


Frosted glass


Comet tail


Beaten egg


String of Pearls


Gelatin Liquefaction

Q12.18: What are the culture media used for Bacillus anthracis?
Answer: Selected area

Bacillus Cereus food	MYPA , PEMBA

Q12.19: What are the selective media used for Bacillus cereus?
Answer: MYPA , PEMBA

Q12.20: What are the transport media and selective media used for Neisseria?
Answer:

- Transport media: Amiss media
- Selective media: Modified Thayer Martin Medium
  - o Components:
    1. Vancomycin
    2. Trimethoprim
    3. Nystatin
    4. Colistin

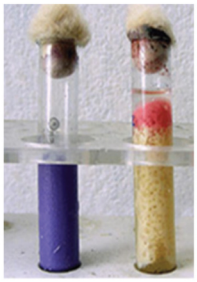
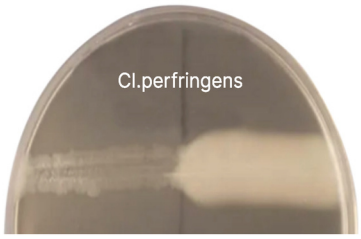
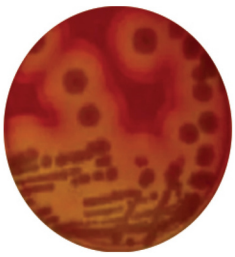
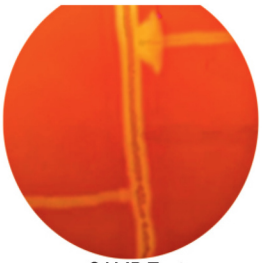
Amiss media - Neisseria (M+G)
Modified Thayer Martin Medium
V = Vodka: Vancomycin
T = Tequila: Trimethoprim
N = Nimbu: Nystatin
C = Chakhna : Colistin

Q12.21: What are the culture media used for different clostridium species?

Answer:

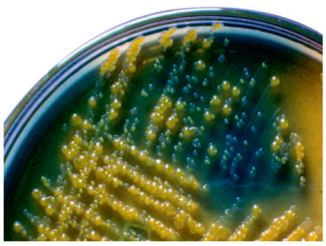
<table>
<tr><th>Organism</th><th>Culture media</th></tr>
<tr><td>Clostridium tetani - Black
RCMB - Anaerobic Media</td><td>Robertson cooked meat broth

Proteolytic reaction

Swarming</td></tr>
<tr><td colspan="2">Clostridium perfringen


Naglar Reaction

Target Hemolysis

CAMP Test
• Stromy clot formation</td></tr>
<tr><td>Clostridium difficile</td><td>Media
• CCFA
• CCYA</td></tr>
</table>

Q12.22: What are differential media used in the diagnosis of UTI?

Answer:

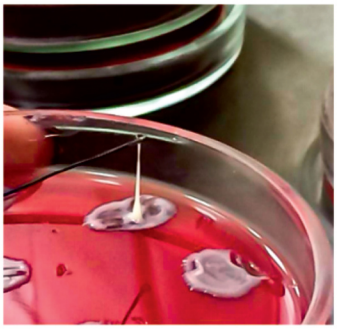
<table>
<tr><td>Mac Conkey agar
LF
Color = pink
P: peptone
L: lactose
A: Agar
N: neutral Red (indicator)
T: Taurocholate (bile salt)
</td><td>CLED
Color = LF= yellow
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</table>

Q12.23: What are the examples of lactose fermenters and non-lactose fermenters?

Answer:

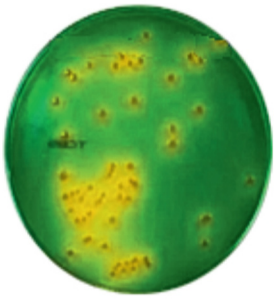
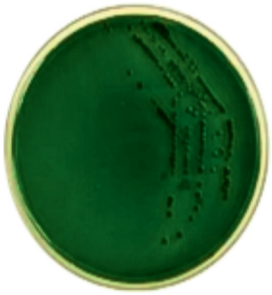
Organism	
Lactose fermenters	E. coli ,klebsiella, enterobacter, citrobacter
Non lactose fermenters	Salmonella, shigella, yersinia, proteus

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Late lactose fermenters	Shigella sonnei
 String Test = Klebsiella	

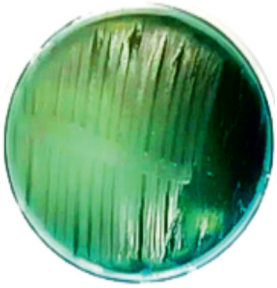
Q12.24: What are the culture media used for the diagnosis of cholera?

Answer:

Organism	Culture media
Vibrio Transport = VR media, Cary blair Media	  TCB (S) • Sucrose fermentation • Color = yellow • Indicator = BTB

Q12.25: What is the selective media used for Pseudomonas?

Answer:

Pseudomonas Blue-green = pyocyanin	 Selective media= cetrimide agar

Q12.26: What is Burkholderia also known as, and what is the culture media used for the diagnosis?

Answer:

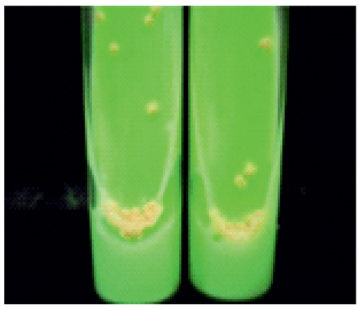
- AKA Vietnam time bomb
- Culture media: ASA (Ashdown selection agar)

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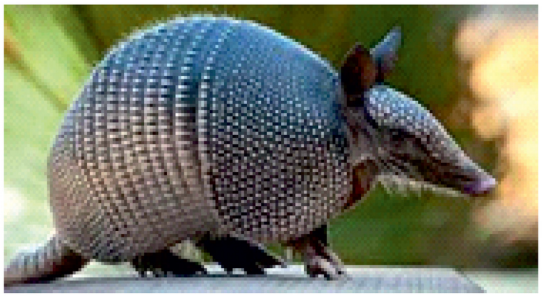
Q12.27: What is the culture media used in mycobacteria, and what is its colony morphology?

Answer:

Mycobacterium TB	LJ media  • Rough Buff tough colonies

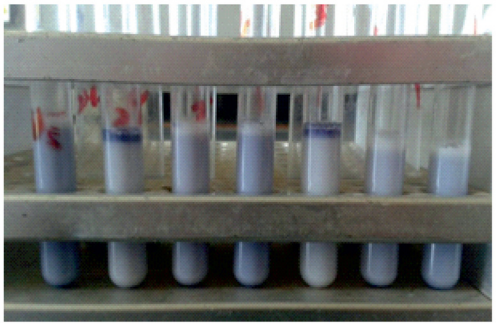
Q12.28: Where is Mycobacterium leprae cultivated?

Answer:



Nine-banded armadillo /footpad of mice

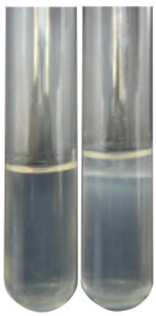
Organism	Culture media
Hemophilus influenza / Pfeiffer bacillus	• Satellitism(grow around staph aureus) • Factor V and X
Q12.29: What are the features of H. influenza? **Answer:** • AKA Pfeiffer bacillus • Satellitism (grow around staph aureus) • Factor V and X	
Hemophilus ducreyi • Painful • Genital ulcer	• Chocolate agar with Isovitalex /fetal calf serum
Q12.30: What are the features of H. ducreyi? **Answer:** • Symptom: Painful, genital ulcer • Culture: Chocolate agar with Isovitalex /fetal calf serum	
Bordetella pertussis	• Bordet gengou media • Dissected pearls or aluminium paint
Q12.31: What is the colony morphology of Bordetella pertussis? **Answer:** Selected area	

Brucella Animal milk ring test 	Castaneda Biphasic media

Q12.32: What is the culture media used for Brucella?

Answer:

- Castaneda Biphasic media
- Animal milk ring test (use the image below)

Organism	Culture media
Leptospira	 • Dinger's ring (EMJH media)

Q12.33: What is the culture media used for Leptospira?

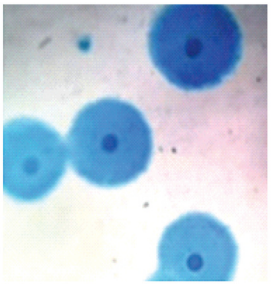
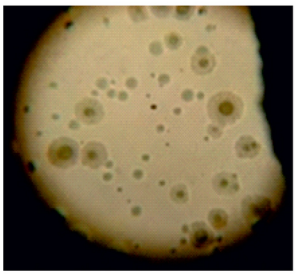
Answer:

EMJH media (Dinger's ring)

Legionella	BCYE media

Q12.34: What is the selective media used for Legionella?

Answer: **BCYE media**

Mycoplasma Diene's Stain 	PPLO agar : Fried EGG colony 

Q12.35: What is the culture media and colony morphology used for mycoplasma?

Answer: Selected area

Q12.36: What are the selective media used for Helicobacter/Campylobacter?

Answer:

- Campy BAP/
- Skirrow /
- Butzler

Q12.37: How are bacteria classified based on their fermentation patterns?

Answer:

	Fermentations	Color	Indicator
MF (s.aureus)	Mannitol salt agar	Yellow	Phenol Red
SF (V.cholera)	TCB (s)	Yellow	BTB
LF (E. coli ,Klebsiella	Macconkey	Pink	Neutral red
LF (E. coli ,Klebsiella	CLED	yellow	BTB

4. VIROLOGY PART - 1

BIG QUESTION 1: What are the key structural components of a typical virus, and how do viruses differ in their symmetry and presence of an envelope?

Broad Answer:

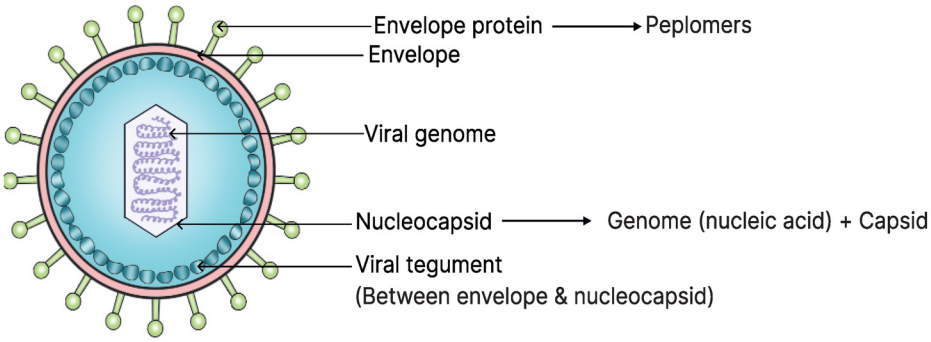
A typical virus consists of an outer envelope with peplomers (projections), an inner nucleocapsid containing the genome (nucleic acid) within a capsid, and a tegument layer between the envelope and nucleocapsid. Viruses can be either enveloped or non-enveloped, and their genome symmetry varies, with most DNA viruses exhibiting icosahedral symmetry (except Poxvirus, which has complex symmetry), and RNA viruses predominantly displaying helical symmetry

DETAILED QUESTIONS

Q1.1: Describe the external and internal components of a virus

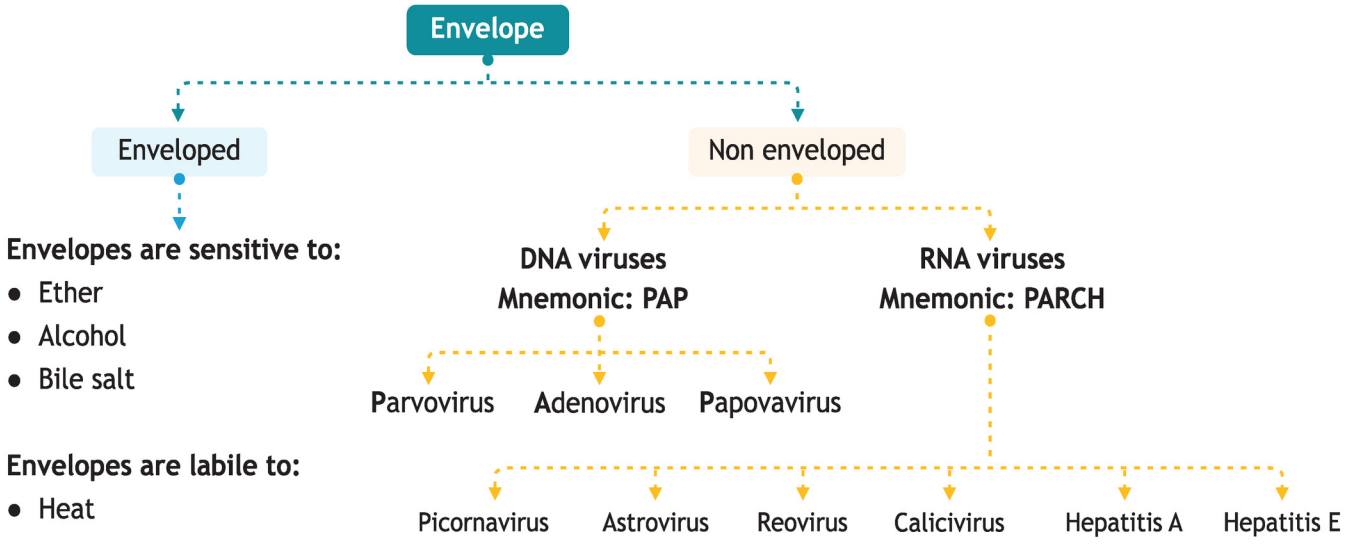
Answer:

- On the outside, there is an Envelope & envelope protein The envelope protein has projections coming out of it known as Peplomers
- In the center, there is a capsid and it has a genome (nucleic acid) Together they are known as Nucleocapsid
- Between the envelope & nucleocapsid there is a Tegument



Q1.2: What are the two main categories of viruses based on their outermost layer?

Answer:



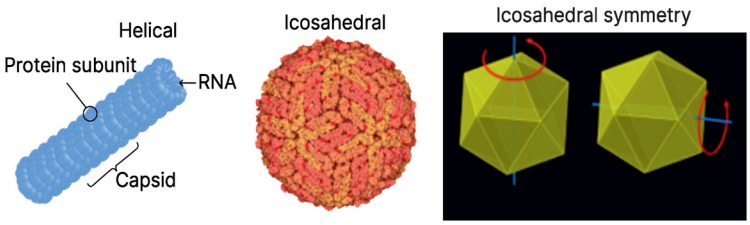
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Q1.3: What type of genome symmetry do most DNA viruses possess, and which DNA virus is an exception to this rule?

Answer:

- All DNA viruses have the Icosahedral symmetry except pox virus



Q1.4: What type of genome symmetry is characteristic of RNA viruses?

Answer:

- The RNA viruses have helical symmetry
- Mnemonic: He is **MR FAB**ulous
  - **M**: Myxovirus
  - **R**: Rhabdovirus
  - **F**: Filovirus
  - **A**: Arenavirus
  - **B**: Bunyavirus

Q1.5: Describe the specific symmetry of the Pox virus

Answer:

- Pox virus has a complex symmetry

Q1.6: How are viruses classified based on the nucleic acid they contain, and their exceptions?

DNA virus(Mnemonic: HAPPy)	RNA virus

• Hepadnaviridae: HBV
• Herpesviridae: HSV, HZV, EBV, CMV, HHV
• Adenoviridae: Adenovirus
• Poxviridae: Smallpox, Cowpox -Variola, Vaccinia, Molluscum
  o Does not include chicken pox
• Papovaviridae: HPV, BL, JC, Polyoma, SV40
• Parvoviridae: Parvovirus
• Bacteriophage - Tadpole shaped
  o Main role in transduction
	• Picornaviridae
	• Paramyxoviridae
	• Caliciviridae
	• Togaviridae
	• Orthomyxoviridae
	• Bunyaviridae
	• Flaviviridae
	• Arenaviridae
	• Coronaviridae
	• Reoviridae
	• Rhabdoviridae
	• Retroviridae
	• Filoviridae

Rules and exceptions
• All DNA viruses are double-stranded except - Parvovirus
  o SsDNA
	Rules and exceptions
	• All RNA viruses have one copy of unsegmented ssRNA except:
	  o Retrovirus - Ex: HIV - has 2 copies

o Smallest size - 20 nm o Shows slapped cheek appearance	o Reo or rotavirus - only dsRNA o Segmented viruses → Mnemonic: BIRA or BORA → Bunyavirus - 3 segments → Influenza virus (Orthomyxoviridae) - 8 segments → Reo or rotavirus - 11 segments → Arenavirus - 2 segments

Q1.7: What is the approximate size range of viruses?

Answer:

- Size ranges from 20 nm to 300 nm

Q1.8: Which virus holds the distinction of being the largest, and what is its approximate size?

Answer:

- Poxvirus is the Largest virus (300 nm)

Q1.9: Which is the smallest virus, and what is its approximate size?

Answer:

- Parvovirus is the smallest virus (20 nm)

Q1.10: Which virus possesses the largest genome?

Answer:

- Largest genome - Retrovirus

Q1.11: Which viruses possess the smallest genomes?

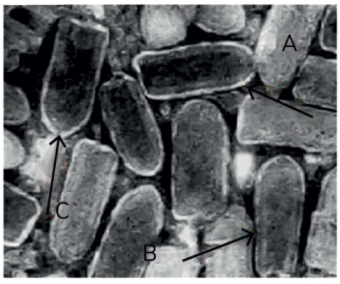
Answer:

- Smallest genome - Hepatitis D, followed by Hepatitis B

Q1.12: Describe the characteristic shape of the Rabies virus

Answer:

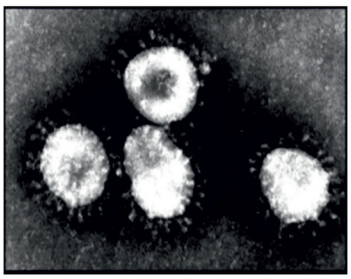
- Rabies- Bullet-shaped



Q1.13: What distinctive structural feature is present on the Coronavirus?

Answer:

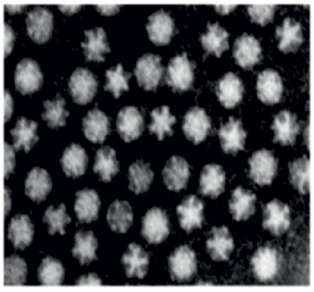
- Coronavirus- crown/petal-like peplomeres



Q1.14: What is the characteristic shape of the Astrovirus?

Answer:

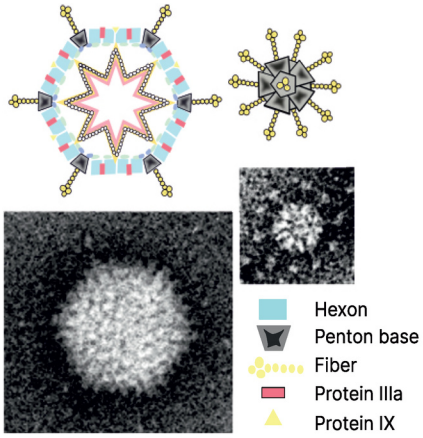
- Astrovirus- star-shaped virus



Q1.15: Describe the characteristic appearance of Adenovirus

Answer:

- Adenovirus under the microscope shows an intranuclear inclusion giving the appearance of a space vehicle.

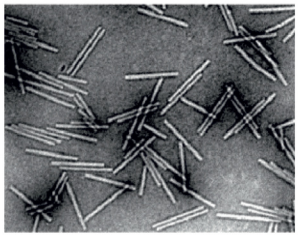


Q1.16: What is the characteristic shape of the Tobacco mosaic virus?

Answer:

- Tobacco mosaic virus: Rod shaped/cigarette shaped

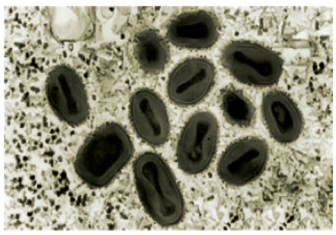




Q1.17: Describe the characteristic shape and core structure of the Pox virus

Answer:

- Pox virus- box/ brick-shaped virus with dumbbell DNA core



Q1.18: Describe the characteristic appearance of the Ebola virus

Answer:

- Ebola virus- bowl of spaghetti/filamentous

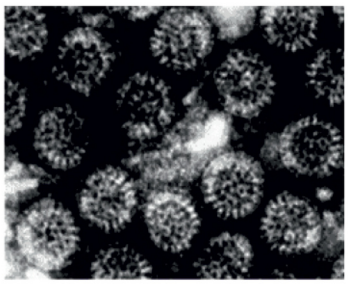


Q1.19: What is the characteristic shape of the Rotavirus, and what common disease does it cause, particularly in children?

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Answer:

- Rotavirus- wheel shaped virus
- Causes diarrhea in children



BIG QUESTION 2: What are the primary methods for cultivating viruses in a laboratory setting, detailing the specific techniques, host systems, and their applications?

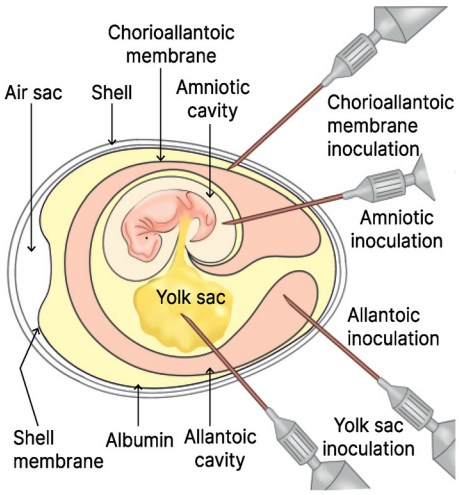
Broad Answer:

Viruses are cultivated using various methods including animal inoculation, embryonated eggs, and cell lines. Animal inoculation, such as in suckling mice, helps in identifying specific viral infections like Coxsackie. Embryonated eggs offer distinct cavities for cultivating different viruses. Cell lines, categorized into primary, secondary, and continuous, provide controlled environments for viral growth, with continuous lines offering indefinite propagation for various viral studies

DETAILED QUESTIONS

Q2.1: What are the methods of viral cultivation?

Answer:

Animal inoculation	Embryonated Egg	Cell Lines
• Ex: Coxsackie A, B virus - injected in the brains of suckling mice. • If flaccid paralysis is present - Coxsackie A. • If Spastic Paralysis is present - Coxsackie B.	• 4 cavities for inoculation o Chorioallantoic membrane (Mnemonic: VVHH) → Vaccinia, variola, HSV1 and 2. o Yolk sac(Mnemonic: CAR)-Chlamydia, Arbovirus, Rickettsia o Amniotic membrane - Influenza isolation. o Allantoic cavity - includes → Yellow fever → Vaccine preparation of influenza and Rabies. 	• 3 cell lines o Primary - primitive → 5 to 10 divisions. o Secondary - 10 to 50 divisions. → Related to human fibroblast cell lines. o Continuous

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Q2.2: What are the three types of cell lines used for virus cultivation, specifying their approximate division capacities and providing examples for each type?

Answer:

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 o CMV • MRC5 • Wi38	• HeLa, • HEP-2, KB, • McCoy, • Vero, • Detroid 6, • BHK, Chang C/I/L/K

BIG QUESTION 3: What are viral inclusion bodies, and what are their diagnostic importance in viral infections?

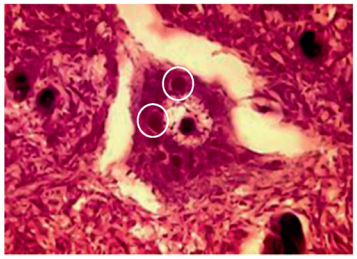
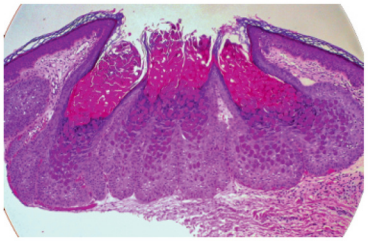
Broad Answer:

Inclusion bodies are characteristic intracellular structures formed during certain viral infections, located either in the cytoplasm (intracytoplasmic) or the nucleus (intranuclear.) Specific types of inclusion bodies are pathognomonic for various viral diseases, such as Negri bodies for Rabies and Cowdry type A/B bodies for Herpes and Adenovirus, respectively

DETAILED QUESTIONS

Q3.1: What are intracytoplasmic and intranuclear inclusion bodies, and what are some examples of each?

Answer:

Intracytoplasmic	Intranuclear
• Negri Bodies - seen in Rabies. • Site - Hippocampus and cerebellum of the brain.  • Paschen bodies - Seen in variola. • Guarnieri bodies - Seen in Vaccinia. • Bollinger bodies - Seen in fowl pox. • Molluscum contagiosum - Presents with umbilicated lesions. o When pressed curdy material is extruded. o Microscopy - Cup-shaped structure. o Contains Henderson Patterson bodies.  	• Mnemonic: HAY BAP o Cowdry type A - Seen in → Yellow fever - Torres bodies. → Herpes - Lipschultz. o Cowdry type B - Seen in → Adenovirus → Poliovirus

Q3.2: What specific stain is positive for Henderson Patterson bodies?

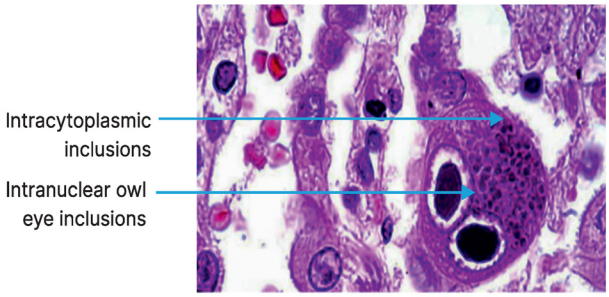
Answer:

- Henderson Patterson bodies - Positive for phloxine tartrate stain

Q3.3: Which two viruses are known to produce both intracytoplasmic and intranuclear inclusion bodies, and what are the characteristic appearances associated with each?

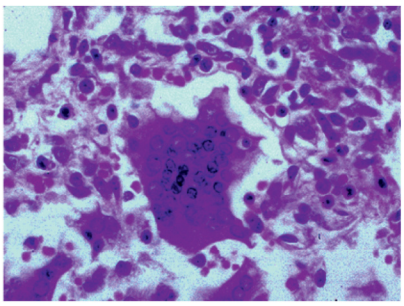
Answer:

- Both intracytoplasmic and intranuclear inclusions bodies seen in:
  - CMV - Shows Owl eye appearance



CMV

  - Measles - Shows Warthin finkeldey giant cells



BIG QUESTION 4: How are Human Herpesviruses (HHVs) classified, and what are their key morphological features, modes of pathogenesis, clinical manifestations, diagnostic methods, and management of HHV1 and HHV2 infections?

Broad Answer:

PYQ: FMGE 2018, 2019

PYQ: AIIMS 2021

- Human Herpesviruses are classified numerically from HHV1 to HHV8
  - HHV1 - Human Herpes Simplex Virus 1
  - HHV2 - Human Herpes Simplex Virus 2
  - HHV3 - Human Herpes Zoster Virus (Chickenpox, Zoster/shingles)
  - HHV4 - Human Herpesvirus Epstein-Barr virus
  - HHV5 - Human Herpesvirus Cytomegalovirus (largest member)
  - HHV6 - Human Herpesvirus 6
  - HHV7 - Human Herpesvirus 7
  - HHV8 - Human Herpesvirus 8

DETAILED QUESTIONS

Q4.1: What are the common Central Nervous System (CNS) infections caused by HSV, and which HSV type is predominantly associated with each?

Answer:

- CNS Infections: HSV1>>>>HSV2
  - Encephalitis:
    - → The most common cause of acute sporadic viral encephalitis
    - → Temporal Lobe

- Meningitis:
  - → Mollaret's Meningitis (Recurrent Lymphocytic Meningitis)
  - → Most commonly seen with HSV-2

Q4.2: List other notable clinical manifestations associated with Herpes Simplex Virus infections

Answer:

- Herpes Gladiatorum (also known as wrestler herpes)
- Eczema Herpeticum
- Erythema Multiforme
- Herpetic Whitlow (seen in healthcare workers)



Herpetic Whitlow

Q4.3: What are the key laboratory diagnostic methods for Herpes Simplex Virus?

PYQ: NEET PG 2019

Answer:

- TZANCK smear
- Lipschultz bodies
- In the cytopathic effect, Shows 3M:
  - Multinucleated
  - Molding
  - Margination

Q4.4: Differentiate between HSV1 and HSV2 based on their typical transmission, latency sites, age groups affected, and characteristic clinical features

PYQ: NEET PG 2023

Answer:

	HSV1 (above the waist)	HSV2 (below the waist)
Transmission	Mucosa/ Abraded Skin	Sexual/ Vertical
Latency	Trigeminal ganglia	Sacral ganglia
Age	Children	Adults
Clinical Features	Orofacial Lesions, Skin Lesions above waist, Encephalitis, Meningitis	Genital Lesions, Below the waist, Neonatal Herpes **(from mother to child)**

Q4.5: What is the most common site for HSV-1 lesions, its most common primary lesion, and its most common recurrent lesion?

Answer:

- Most Common Site: Buccal Mucosa
- Most Common 1° Lesion: Gingivostomatitis
- Most Common Recurrent Lesion: Herpes Labialis

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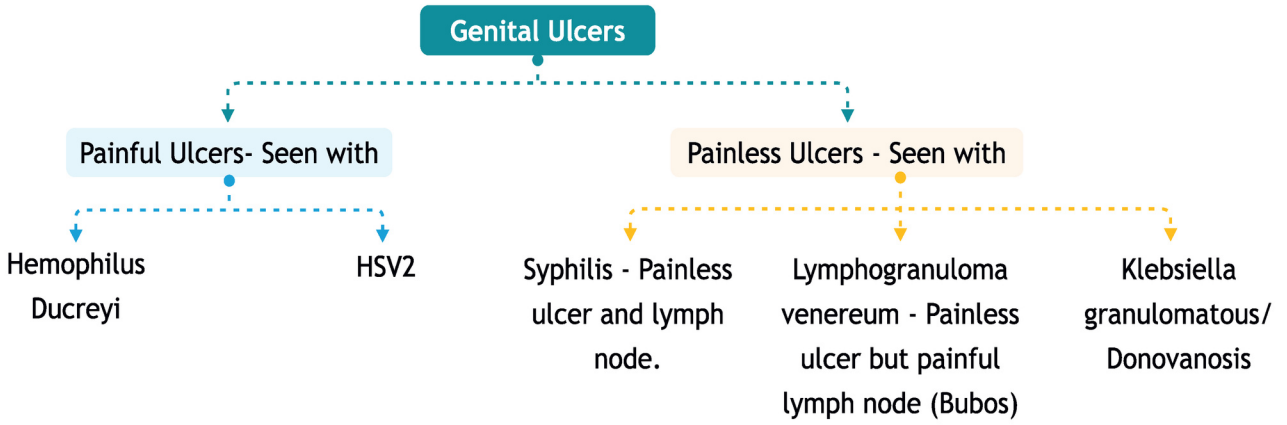
Q4.6: What is the drug of choice for treating Herpes Simplex Virus infections, and what alternative drug is used in cases of resistance?

Answer:

- DOC - Acyclovir
- Resistance - Foscarnet

Q4.7 How can genital ulcers be differentiated based on the presence or absence of pain?

Answer:



BIG QUESTION 5: What are the two primary clinical manifestations of Human Herpesvirus 3 (VZV) infection, how do their clinical presentations differ, and what are the key complications and specific syndromes associated with each?

Broad Answer: Human Herpesvirus 3 (VZV), also known as Herpes Zoster/Varicella-Zoster, causes chickenpox in children and Herpes Zoster (shingles) in adults. Chickenpox is characterized by a centripetal rash with crops of lesions ("dew drop on a rose petal") and can lead to secondary bacterial skin infections or, more seriously, varicella pneumonia. Shingles, a reactivation of latent virus, presents as a painful vesicular rash along a dermatomal distribution.

DETAILED QUESTIONS

Q5.1: What are the two common names for Human Herpesvirus 3, and what diseases does it cause in children and adults, respectively?

Answer:

- Known as Herpes Zoster/Varicella-Zoster
- In children causes chickenpox
- In adults causes Herpes Zoster/shingles

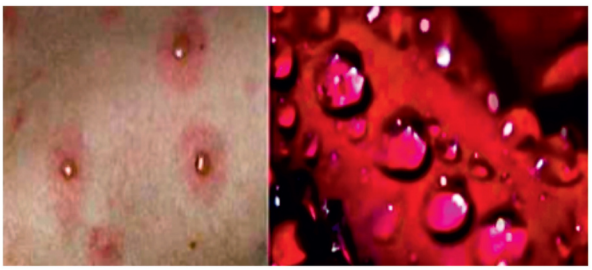
Q5.2: What are the pathogenesis and clinical features of chicken pox?

Answer:

- **Incubation Period:** Typically 14 to 21 days (2 to 3 weeks).
- **Rash Distribution:** Bilateral, diffuse, and predominantly centripetal—initially appearing on the trunk and then spreading to the extremities.
- **Spread Pattern:** The rash begins centrally and spreads peripherally (centrifugally), often involving the flexor surfaces.

YOURWISH

- **Lesion Characteristics:** The rash appears in crops, with new lesions emerging over several days. Each crop is accompanied by fever.
- **Classic Description:** "Dew drop on a rose petal"—characterized by a clear vesicle on an erythematous base.



Q5.3: What are the complications associated with chicken pox?

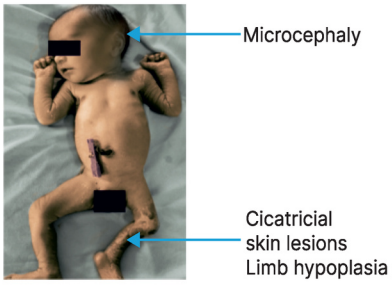
Answer:

- Complications: With superadded bacterial infections.
- Most Common Complication: Secondary Bacterial Skin Infection
- Most Common Extra-Cutaneous Complication: CNS Involvement (Benign Cerebellar Ataxia)
- Most Serious Complication: Varicella Pneumonia (especially in pregnancy)

Q5.4: What is Fetal Congenital Varicella Syndrome, and what are its characteristic clinical features?

Answer:

- Infection within 20 weeks of IUL
  - Microcephaly
  - Cortical Atrophy
  - Limb Hypoplasia
  - Cicatricial skin Lesion



Q5.5: What is the pathogenesis of Herpes Zoster (shingles), and when does reactivation typically occur?

Answer:

- **The Varicella-Zoster Virus (VZV)**, which causes chickenpox, becomes latent in the dorsal root ganglia after the initial infection.
- **Reactivation** can occur later in life, particularly in the elderly or in individuals with weakened immune systems, leading to **Herpes Zoster (Shingles)**

Q5.6: Describe the characteristic distribution and nature of the rash in Herpes Zoster

Answer:

- Unilateral Rash
- Segmental because of the Dermatomal distribution (M/c D3 to L2)
- Painful rash



Q5.7: What are the common complications of Herpes Zoster?

Answer:

- Complications:
  - Post Herpetic Neuralgia M/c; Pain at the local site
  - Zoster Ophthalmicus

- Ramsay Hunt Syndrome:
  - → Involvement of the Geniculate Ganglion of the 7th Nerve
  - → Facial Nerve Palsy has this syndrome
  - → Vesicles at EAM, Otalgia
  - → Loss of taste sensation at anterior 2/3rd of the tongue



Zoster Ophthalmicus

BIG QUESTION 6: What are the pathogenesis, clinical manifestations, diagnosis, and treatment of Epstein-Barr Virus infection?

Broad Answer:

Epstein-Barr Virus (EBV) primarily causes polyclonal B cell activation by entering B cells via CD21/CR2 and expressing molecules like LMP1 and EBNA2. Clinically, it leads to Infectious Mononucleosis and a range of malignancies, including carcinomas (gastric, nasopharyngeal), lymphomas (Hodgkin's, non-Hodgkin's), and sarcomas

DETAILED QUESTIONS

Q6.1: Describe the pathogenesis of Epstein-Barr Virus infection

Answer:

- It causes Polyclonal B cell activation
- It enters the B cell through CD21/ Cr2
- Molecules EBV have: LMP 1, EBNA2 (activates the SRC protooncogenes), vIL10 (anti-inflammatory)

Q6.2: What are the common clinical features of Infectious Mononucleosis?

Answer:

- Infectious Mononucleosis also known as the *"kissing disease"* or *glandular fever*
  - Common in adolescents and young adults
  - Characterized by fever, sore throat, lymphadenopathy, and splenomegaly

Q6.3: What types of malignancies are associated with Epstein Barr Virus infection?

Answer:

- Carcinoma : Most commonly causes Gastric Carcinoma, f/b nasopharyngeal carcinoma
- Lymphoma: It is of two types,
  - Hodgkin (mixed cellularity)
  - Non-Hodgkin lymphoma (Burkitt's, DLBCL, Post Transplant Lymphoma)
- Sarcoma: LMS (Leiomyosarcoma)

Q6.4: List other notable conditions associated with Epstein Barr Virus infection

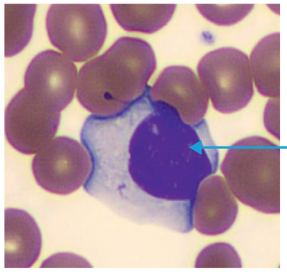
Answer:

- Duncan Syndrome (Lymphoproliferative syndrome)
- Hairy cell leukoplakia/ Oral cell leukoplakia

Q6.5: What are the characteristic microscopic appearances seen in Epstein-Barr Virus (EBV) infection?

Answer:

- Blood Sample: Atypical Lymphocytes (Downey cells)
- Composition: CD8 T Lymphocytes
- Also called "Ballerina Skirt Appearance"



Q6.6: Which serological tests are used for Heterophile Antibody Detection in EBV infection?

PYQ: AIIMS 2021

Answer:

- Heterophile Antibody Detection:
  - Paul Bunnell Test (old)
  - Monospot Test (New)

Q6.7: What specific antibody tests are available for EBV diagnosis?

Answer:

- Specific Antibody Test:
  - Antibody to viral capsid antigen
  - Antibody to early antigen
  - Antibody to EBNA

Q6.8: What is considered the most sensitive and specific test for Epstein-Barr Virus?

Answer:

- Most sensitive and specific test: Nucleic Acid Hybridisation Test

Q6.9: What are the primary treatment options for Epstein Barr Virus-related conditions?

Answer:

- Acyclovir (oral hairy leukoplakia)
- Rituximab

BIG QUESTION 7: What are the pathogenesis, clinical features, and laboratory diagnosis, and management of Cytomegalovirus infection?

Broad Answer: Cytomegalovirus (CMV), the largest member of the Herpesviridae family, has humans as its sole reservoir and is primarily transmitted via oral, respiratory, and body secretions

- It multiplies in (Mnemonic: SRK in MANNAT)
  - Salivary glands
  - Respiratory tract
  - Kidneys
  - Remains latent in monocytes

DETAILED QUESTIONS

Q7.1: What are the routes of Cytomegalovirus transmission?

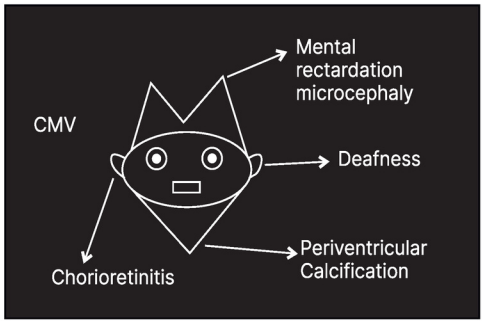
Answer:

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- Most Common: Oral, Respiratory, Body Secretions
- Less Common: Transplacental, Sexual

Q7.2: What are the various infections associated with Cytomegalovirus (CMV)?

Answer:

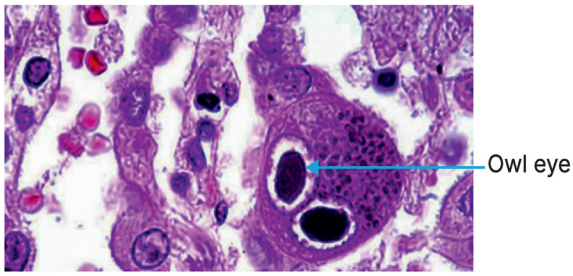


- Congenital: The most common intrauterine infection associated with congenital defects
- Perinatal: Usually Asymptomatic
- Immunocompromised: CMV chorioretinitis
- Immunocompetent: IMN (Glandular Fever) like syndrome - Fever, Sore Throat, No LN, spleen, No antibodies

Q7.3: What are the key laboratory diagnostic methods for Cytomegalovirus?

PYQ: NEET PG 2023

Answer:



- Inclusion Bodies: Owl eye appearance (Has both intracytoplasmic and intranuclear inclusions)
- Virus Isolation: Human Fibroblast cell line (2° Cell Line) from Urine Washing specimen
- Antibody Detection: ELISA
- Antigen: PP65 antigen is detected
- PCR

Q7.4: What is the drug of choice for Cytomegalovirus treatment, and what alternative drug is used if resistance occurs?

Answer:

- DOC - Ganciclovir
- If resistance - Foscarnet

BIG QUESTION 8: What are the cellular targets, variants, modes of transmission, and characteristic clinical presentations of Human Herpesvirus 6 (HHV6) infection in children and adults?

Broad Answer: Human Herpesvirus 6 (HHV6), with variants 6A and 6B, primarily binds to T cells via the CD46 receptor and is transmitted through oral secretions In children, it typically causes "Sixth Disease" (Roseola Infantum)

DETAILED QUESTIONS

Q8.1: Describe the characteristic clinical presentation of Human Herpesvirus 6 infection in children

Answer:

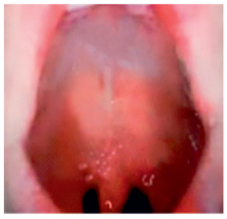
- **In children: Sixth disease / roseola infantum / exanthem subitum**
- **Clinical Features:**
  - **High-grade fever** lasting 3-5 days
  - **Nagayama spots:** Erythematous papules on the soft palate and uvula

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- **Rash:**
  - → Appears **after the fever subsides** ("rash follows defervescence")
  - → **Rose-pink, non-pruritic, maculopapular or papular** rash
  - → Typically starts on the **trunk** and spreads to the **neck and extremities**



Fever



Erythematous, Rash on soft palate and uvula



Rose pink non pruritic papules

Q8.2: How does Human Herpesvirus 6 infection typically manifest in adults?

Answer:

- In adults: Mononucleosis-like syndrome

BIG QUESTION 9: What are the major clinical manifestations associated with Human Herpesvirus 8 (HHV8) infection, and their key characteristics?

Broad Answer: Human Herpesvirus 8 (HHV8) is primarily associated with Kaposi Sarcoma, a vascular tumor most common in HIV-infected individuals, predominantly affecting the lower limbs and lymph nodes. It also causes Primary Effusion Lymphoma, characterized by significant effusions and specific CD marker positivity, and Multicentric Castleman Disease, which manifests with B-cell symptoms and distinctive lymph node histological features.

DETAILED QUESTIONS

Q9.1: What is Kaposi Sarcoma, and what are its key associations and most common sites?

PYQ: AIIMS 2018

Answer:

- Kaposi Sarcoma (Vascular Tumor).
- Most associated with HIV.
- Most common site - Lower Limb (skin).
- Second most common site - Lymph Node.

Q9.2: Describe Primary Effusion Lymphoma in terms of its clinical presentation and immunophenotype.

Answer:

- Characterized by **large-volume effusions** in body cavities:
  - Pleural effusion
  - Pericardial effusion
  - Peritoneal (ascitic) fluid
- CD30 and CD38 Positive

Q9.3: What are the clinical features of Castleman disease?

Answer:

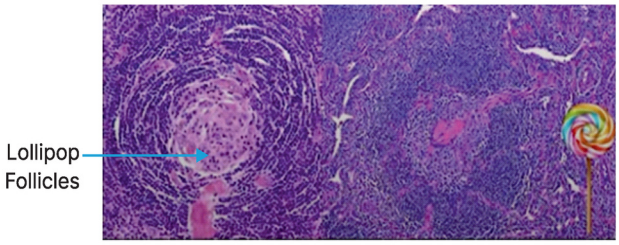
- **Site of Involvement:**
  - Primarily affects **lymph nodes**, commonly in the **mediastinum**, **neck**, **abdomen**, or **axilla**.
- **Symptoms (especially in Multicentric Castleman Disease):**

- B symptoms:
  - → Fever
  - → Night sweats
  - → Weight loss
- Fatigue, hepatosplenomegaly, and generalized lymphadenopathy may also be present.

Q9.4: What are the key histopathological appearances associated with Castleman disease?

Answer:

- **"Onion-skinning":**
  - → Refers to **concentric layers of lymphocytes** surrounding atrophic germinal centers.
- **"Lollipop follicles":**
  - → Characterized by a **hyalinized blood vessel** penetrating into the center of a germinal follicle, resembling a lollipop.



BIG QUESTION 10: What are the characteristics, modes of transmission, cellular targets, and range of clinical conditions associated with Parvovirus B19 infection?

Broad Answer: Parvovirus, the smallest single-stranded DNA virus with icosahedral symmetry, primarily spreads via respiratory routes, blood transfusion, and transplacentally. It targets P antigen on RBC precursors. Parvovirus B19 is associated with Erythema Infectiosum ("Fifth Disease" or "slapped cheek appearance"), Gloves and Socks Syndrome, arthritis/arthralgia, Aplastic Crisis (especially in hemolytic anemia), Pure Red Cell Aplasia, and Hydrops Fetalis

DETAILED QUESTIONS

PYQ: AIIMS 2022, 2023 | PYQ: NEET PG 2019 | PYQ: FMGE 2021

Q10.1: What are the key virological characteristics of Parvovirus?

Answer:

- Smallest virus (20nm)
- Only single-stranded DNA virus
- Icosahedral symmetry

Q10.2: What are the primary modes of transmission for Parvovirus?

Answer:

- Respiratory route
- Blood transfusion
- Transplacental transmission

Q10.3: What are the various clinical conditions associated with Parvovirus B19 infection?

Answer: PYQ: AIIMS 2019

- **Erythema Infectiosum (Fifth Disease)**
  - Slapped cheek appearance:
  - Macular erythematous rash present on cheek

- Lacy rash on rest of the body
- Prodromal symptoms:Fever, sore throat
- Self-limiting illness

- Gloves & socks syndrome
- Arthritis, Arthralgia
- Aplastic Crisis (in Hemolytic Anemia Parvovirus B19)
  - Hemolytic crisis is a/w EBV
- Pure red cell aplasia: a/w Thymoma
- Hydrops Fetalis



Q10.4: Which cellular receptor does Parvovirus B19 attack on red blood cell precursors?
Answer: P antigen of RBC'S Precursors.

BIG QUESTION 11: What are the primary viruses classified under Papovaviridae, and what are their features and associated clinical presentations?

Broad Answer: The Papovaviridae family includes Papilloma Virus (HPV) and various Polyoma viruses. Polyoma viruses such as Merkel Cell Virus, SV40, JC Virus, and BK Virus are associated with distinct pathologies: Merkel Cell Carcinoma (a neuroendocrine tumor), Mesothelioma, Progressive Multifocal Leukoencephalopathy (PMLE), and kidney transplant-related nephropathy with characteristic "decoy cells" in urine, respectively

DETAILED QUESTIONS

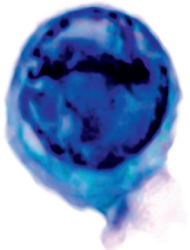
Q11.1: What are the two main genera of viruses classified under Papovaviridae?
Answer:

- Papilloma Virus: HPV
- Polyoma virus

Q11.2: What are the diseases associated with Polyomaviruses?
Answer:

- Merkel Cell Virus - Merkel Cell Carcinoma (Neuroendocrine Tumor around the skin)
- SV 40: a/w Mesothelioma
- JC Virus: Causes PMLE (progressive multifocal leukoencephalopathy)

Q11.3: What is the clinical significance of BK virus infection, and how can it be identified in affected patients?
Answer:



- BK virus infection:
  - Usually seen in Post-Kidney Transplant Patients
  - Urine microscopy shows huge cells with a nucleus that mimics cancer cells (malignancy) that is decoy cells

BIG QUESTION 12: What are the morphology, pathogenesis, clinical manifestations, oncogenic associations, and laboratory diagnostic methods of Human Papillomavirus (HPV) infection?

Broad Answer:
Human Papillomavirus (HPV) strains are categorized by their risk for disease, causing both cutaneous and mucosal lesions. Low-risk types (HPV 1, 2, 3, 6, 11) typically cause skin and genital warts, while high-risk types (HPV 5, 8, 16, 18, 31, 33, 35)

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DETAILED QUESTIONS



Q12.1: What are the cutaneous manifestations of HPV?

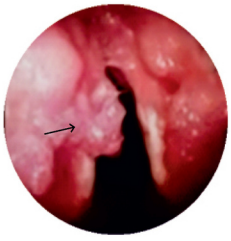
Answer:

- HPV 1,2,3 (Low risk) - Shows skin warts
- HPV 5,8 (High risk) - Tree man Syndrome / Epidermodysplasia Verruciformis (a/w chr 17 defect)

Q12.2: What are the mucosal abnormalities associated with Human Papillomavirus (HPV), and which HPV types are responsible?

Answer:

- HPV 6,11 (Low risk)
  - o Shows mucosal warts
  - o Genital warts as Condyloma Acuminatum
- HPV 16,18,31,33,35 (High risk)
  - o Results in Squamous Cell Carcinoma - present in:
    - → Cervical
    - → Penile
    - → Anal regions
    - → Oral cavity
    - → Esophagus





Q12.3: What is the clinical significance of the structural and non-structural proteins of Human Papillomavirus (HPV)?

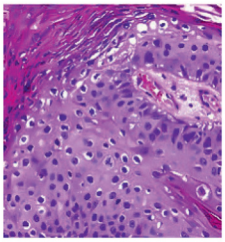
Answer:

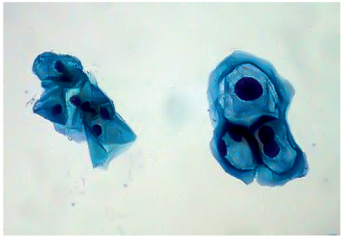
- L1 capsid protein is used for making a vaccine
- E2 is the controller (supervisor)
- E4 & E5 are responsible for making changes in cells called Koilocytes
- E6 & E7 are responsible for Carcinogenesis - inactivating tumor suppressor genes
  - o E6 inactivates the p53 (policeman)
  - o E7 inactivates the RB (governor gene)

Q12.4: What is a koilocyte?

Answer: A koilocyte is a squamous epithelial cell that has undergone structural changes due to HPV infection, characterized by:

- Enlarged irregular nucleus (Raisanoid)
- Perinuclear cytoplasmic clearing (halo)

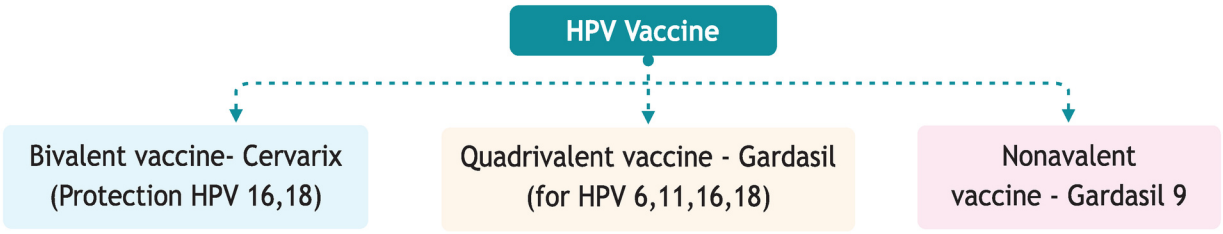




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Q12.5: What are the types of HPV vaccines and their protective HPV types?

Answer:



BIG QUESTION 13: What are the morphology and clinical manifestations of Adenovirus infections?

Broad Answer: Adenovirus is a non-enveloped virus .It causes a wide range of clinical conditions, including hemorrhagic cystitis, infant diarrhea, various eye infections (epidemic keratoconjunctivitis, pharyngoconjunctival fever), and respiratory diseases, with specific serotypes often associated with particular syndromes and patient populations like transplant recipients

DETAILED QUESTIONS

Q13.1: What is the structure of Adenovirus?

Answer:

- Space vehicle-shaped
- Non enveloped

Q13.2: Which Adenovirus strains are associated with hemorrhagic cystitis?

Answer: Adenovirus types 11 and 21

Q13.3: Which Adenovirus strains are responsible for infantile diarrhea?

Answer: Adenovirus types 40 and 41

Q13.4: What are the adenovirus-associated diseases of the ocular system?

Answer:

- Epidemic Keratoconjunctivitis/ Shipyard eye: 8,19,37
- Pharyngoconjunctival Fever/ Swimming Pool conjunctivitis: 3,7,14.

Q13.5: What are the respiratory diseases caused by Adenovirus?

Answer:

- URTI: 1,2,3,5.
- Pneumonia: 3,7,21
- Transplant Recipients: 34,35

BIG QUESTION 14: What are the types of Hepatitis viruses, and how do they differ in their morphology, modes of transmission, pathogenesis, clinical manifestations, complications, and laboratory diagnosis?

Broad Answer: Hepatitis viruses (A-E) are hepatotropic viruses causing inflammation of the liver, but they belong to different viral families. They differ in structure, transmission, pathogenesis, and outcome, ranging from self-limited acute hepatitis to chronic liver disease and hepatocellular carcinoma.

- Hepatitis B - DNA Virus.
- Other Hepatitis - RNA Virus

DETAILED QUESTIONS

Q14.1: Why is there no vaccine for Hepatitis C?

Answer:

- Because it follows quasispecies - mutate when a vaccine is made for a variant

Q14.2: What are the characteristics of Hepatitis G ?

Answer:

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

Q14.3: Describe the laboratory diagnosis of Hepatitis A Virus (HAV), including shedding patterns and antibody appearance

Answer:

- HAV shedding in stool: From 2 weeks before to 2 weeks after the onset of symptoms.
- IgM appears with the onset of jaundice
- 2-4 weeks later IgG seen

Q14.4: What is the most common cause of fulminant viral Hepatitis overall, and specifically in pregnancy?

Answer:

- Most common cause of fulminant viral Hepatitis - Hepatitis D
- Most common cause of fulminant viral Hepatitis in pregnancy - Hepatitis E

Q14.5: What are the most common causes of sporadic acute Hepatitis in India, transfusion-related Hepatitis, chronic Hepatitis, and viral Hepatitis causing cancer?

Answer:

- Most common cause of sporadic acute Hepatitis in India - Hepatitis E
- Most common cause of transfusion-related Hepatitis - Hepatitis B
- Most common cause of chronic Hepatitis - Hepatitis B
- Most common cause of viral Hepatitis, causing cancer - Hepatitis B

Q14.6: Which Hepatitis virus has the maximum risk and potential for chronicity, and for causing cancer?

Answer:

- Hepatitis C

Q14.7: What is the most common cause of the carrier state among Hepatitis viruses?

Answer:

- The most common cause of carrier state - Hepatitis B

Q14.8: Describe the characteristics of the Hepatitis B genome

Answer:

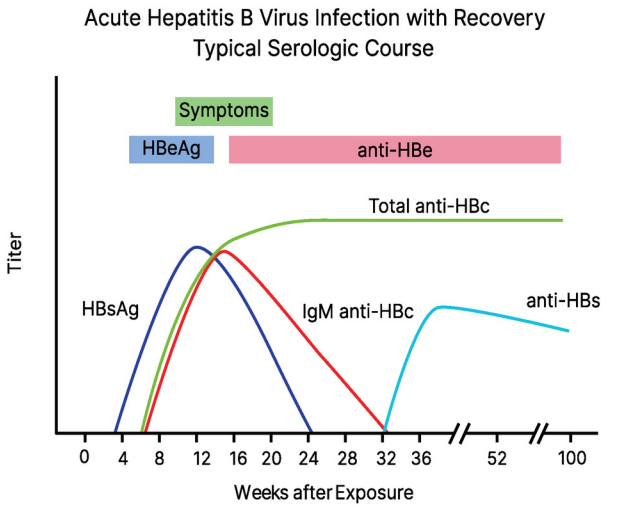
- DNA virus (Partial Double Stranded)

Q14.9: What is the timeline and significance of Hepatitis B surface antigen (HBsAg) in laboratory diagnosis?

Answer:

PYQ: AIIMS 2020

- 1st antigen to appear is Hepatitis B surface antigen
- 2-6 weeks before onset of symptoms
- Disappears in 1-2 months after onset of jaundice
- Epidemiological marker: Anti-Hbs



Q14.10: What is the significance of HBe Antigen and Anti-HBe in Hepatitis B infection?

Answer:

- HBe Antigen
  - Appears shortly after HBsAg
  - Tells the infectivity rate→ high infectivity
- Anti-HBe - ↓ in infectivity

Q14.11: What is the significance of HBc core antigen?

Answer:

- HBc core antigen is stuck inside and won't be released in the blood
- Not detected in blood
- Antibodies are made for it
- IgM and IgG
- Covers the window period

Q14.12: What are the four major components of the Hepatitis B genome and their respective functions/ characteristics?

Answer:

Genome has			
P: DNA Polymerase • Largest • Reverse transcriptase • RNAase	C: Core antigen • Has a core area and a pre-core area. • Core area coats C antigen. • Pre-core coats E antigen. (HbcAg and HbeAg)	S: Surface Antigen (Australia Antigen)-HbsAg • Surface antigen • These have different sizes (Small, medium and large) • Orcein shikata stain.	X: HBX responsible for carcinogenesis • Liver

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Q14.13: How are the various Hepatitis B serological markers interpreted?

Answer:

HBsAg	Anti - HBs	Anti - HBc	HBeAg	Anti - HBe	Interpretation
+	-	IgM	+	-	Acute Hepatitis B- High infectivity
+	-	IgG	+	-	Chronic Hepatitis B -High Infectivity
-	+	+ [IgM + IgG]	-	+	Recovery
-	+	-	-	-	Immunity
-	-	+ [IgM]	-	-	Window period

- Acute Hepatitis: Mnemonic: SEMA
- Chronic Hepatitis: Mnemonic: SEGC

Q14.14: Differentiate between Co-infection and Superinfection with Hepatitis D

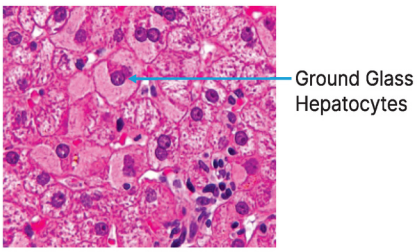
Answer:

- Co-infection: HBV + HDV infection together
- Superinfection: Patient already has HBV, superinfected with HDV

Q14.15: Where is the ground-glass appearance of hepatocytes seen?

Answer:

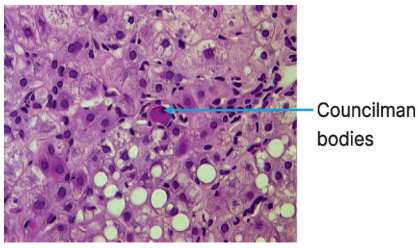
- Seen with hepatitis B infection
- Has surface Ag - Orcein shikata stain



Q14.16: What are Councilman bodies, and with which viral Hepatitis are they commonly seen?

Answer:

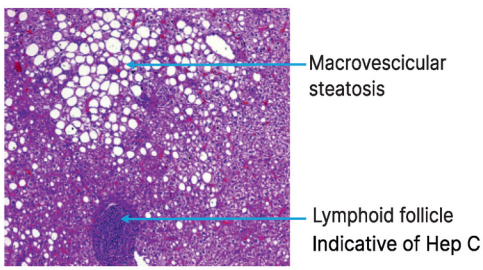
- Seen in viral Hepatitis, especially with HCV
- These are apoptotic bodies



Q14.17: What are the features of fatty changes seen in the liver?

Answer:

- Seen in Hepatitis C
- Shows:
  - Macrovesicular fatty change
  - Lymphoid aggregates - blue structures



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Q14.18: What is the purpose of a liver biopsy in Hepatitis, and how are grading and staging determined?

Answer:

- Liver biopsy - Done to know the staging and grading of Hepatitis
- Grading: based on Inflammation and necrosis (Mnemonic: GIN)
- Staging: based on Fibrosis

Q14.19: What are the notable extrahepatic manifestations associated with Hepatitis B infection?

Answer:

- Polyarteritis nodosa (PAN) - 30%
- Membranous glomerulonephropathy (MGN)

Q14.20: What are the notable extrahepatic manifestations associated with Hepatitis C infection?

Answer:

- Membranoproliferative glomerulonephropathy (MPGN)
- Mixed cryoglobulinemia
- Lichen planus - Colloid or Civatte bodies are seen

Q14.21: Summarize the features of Hepatitis viruses.

PYQ: AIIMS 2018, 2020

Mnemonic	Private	Hospitals	Favor	Rich	Clients
Feature (Virus)	**HAV**	**HBV**	**HCV**	**HDV**	**HEV**
Genome	RNA	DNA	RNA	RNA	RNA
Family	**P**icornaviridae Enterovirus	**H**epadnaviridae	**F**laviviridae	**R**elies on HBV	**C**alicivirus Now Hepeviridae
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	- (Quasispecies)	- (Protection from B)	yes
Fulminant				5-20% The most common cause of pulmonary hepatitis	1-2% (25% chance in Pregnancy)

5. VIROLOGY PART 2

BIG QUESTION 1: What are the characteristics, pathogenesis, diagnosis, and treatment of Orthomyxoviruses and Paramyxoviruses?

Broad Answer:

- Orthomyxoviruses and Paramyxoviruses are RNA viruses associated with respiratory infections.
- Orthomyxoviruses include Influenza A, B, and C and are known for antigenic shift and drift.
- Paramyxoviruses include Measles, Mumps, RSV, Parainfluenza, and Nipah.
- Diagnosis is clinical and lab-based; treatment includes antiviral agents like oseltamivir for influenza and supportive therapy for other viruses.
- Vaccines exist for measles, mumps, and rubella.

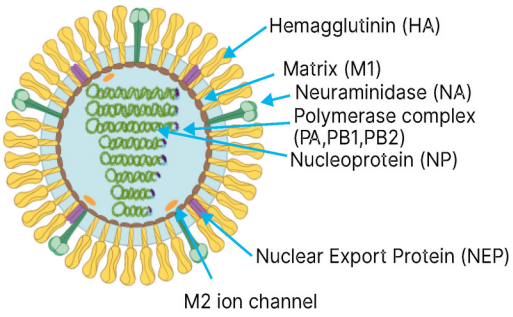
DETAILED QUESTIONS

PYQ: FMGE 2022 PYQ: AIIMS 2019,2022

Q1.1: What are the structural features and viral proteins of Orthomyxoviruses?

Answer:

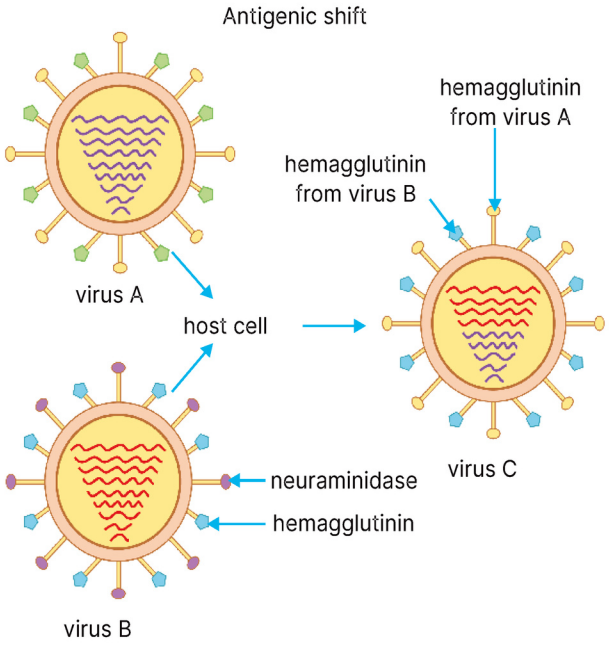
- Members of Orthomyxovirus family: Influenza A, B, C
- Structure contains two surface proteins:
  - Hemagglutinin (HA): Mediates virus entry
  - Neuraminidase (NA): Helps in virus exit/release
- M2 ion channel: Assists in uncoating of virion inside host cell
- Drugs targeting M2 ion channel (Influenza A only):
  - Amantadine
  - Rimantadine



Q1.2: What is the difference between Antigenic Shift and Antigenic Drift in Influenza viruses?

Answer:

Feature	Antigenic Shift	Antigenic Drift
Type	Sudden genetic change	Gradual mutations
Mechanism	RNA segment reassortment	Point mutations in HA/NA genes
Seen in	Influenza A only	Influenza A and B
Speed	Rapid	Slow
Clinical impact	Major epidemics, pandemics	Seasonal flu



Q1.3: What are the clinical features and diagnostic methods of Influenza?

Answer:

- Symptoms:
  - Fever, headache, sore throat, cough, myalgia
  - *Running nose is usually absent*
  - Complication: Pneumonia
- Lab Diagnosis:
  - Specimen: Nasopharyngeal swab
  - Test: Hemagglutination inhibition (HAI) test → positive
- Treatment:
  - NA inhibitors:
    - → Tamiflu/Oseltamivir(oral)
    - → Zanamivir/relenza (inhalation)
  - M2 inhibitors (Influenza A only):
    - → Amantadine
    - → Rimantadine

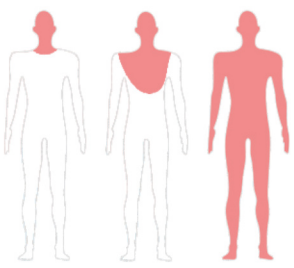
Q1.4: What are the features, complications, and diagnosis of Measles virus (Rubeola)?

Answer:

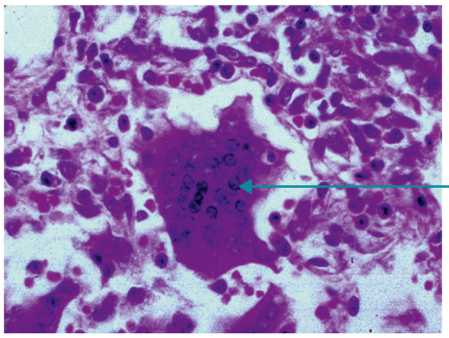
PYQ: FMGE 2019

- Incubation Period: 10 days
- Prodromal symptoms: Fever, 3 C's
  - Cough
  - Coryza
  - Conjunctivitis
- Day 12: Koplik spots (near molars)
- Day 14: Rash appears (starts from ear, face, neck)
- Rash appears after prodrome disappears
- Vaccine strain: Edmonston Zagreb
- Complications:





- SSPE (Subacute Sclerosing Panencephalitis) → fatal, seen 7-10 years after infection PYQ: FMGE 2020
- Warthin-Finkeldey Giant Cells with intranuclear and intracytoplasmic inclusions



Warthin Finkeldey giant cells

Q1.5: What are the clinical features and complications of Mumps virus? PYQ: FMGE 2021

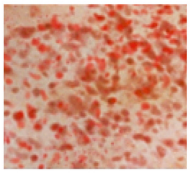
Answer:

- Incubation Period: 19 days
- Most common form: Inapparent
- Most common symptom: Bilateral parotitis
- Second most common: Unilateral orchitis
- Vaccine strain: Jeryl Lynn strain

Q1.6: What are the features of Rubella virus and Congenital Rubella Syndrome (CRS)?

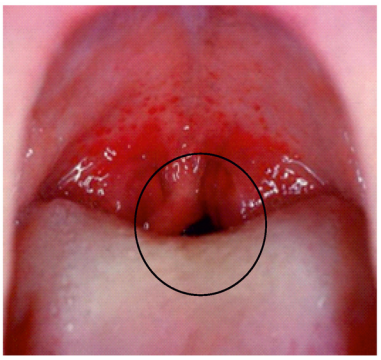
Answer:

- Family: Matonaviridae (Previously Togaviridae)
- AKA: German measles, Three-day measles
- Incubation period: 14 to 21 days
- Symptoms:
  - URTI
  - Rash (3 days)
  - Posterior auricular lymphadenopathy (LAP)
  - Forchheimer spots
- Congenital Rubella Syndrome:
  - PDA (Patent Ductus Arteriosus)
  - Sensorineural hearing loss (SNHL)
  - Cataract
  - Blueberry muffin rash
  - Virus excreted in saliva and urine
- Vaccine strain: RA 27/3



Rash

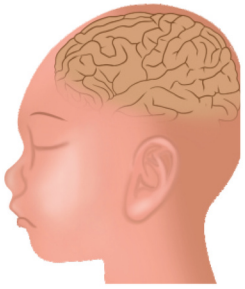




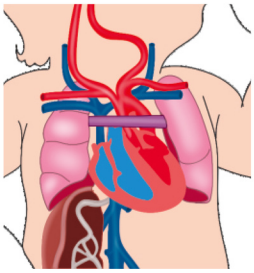
Forschheimer's spot on palate



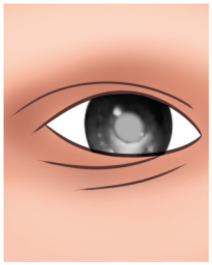
Blueberry muffin syndrome



SNHL



Patent Ductus Arteriosus



Cataract

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Q1.7: What are the features of Respiratory Syncytial Virus (RSV)?

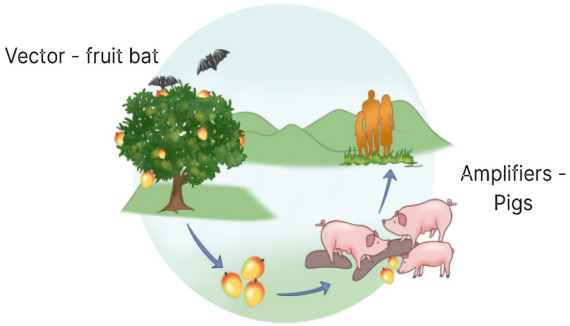
Answer:

- Season: Common in rainy season
- Infants: Most common cause of Lower Respiratory Tract Infection (LRTI)
- Adults: Causes URTI
- Microscopy: Syncytial (multinucleated giant cell) appearance

Q1.8: What are the features of Nipah virus?

Answer:

- Outbreak location: Kerala, 2018
- Mortality: 60–70%
- Symptoms: Encephalitis + fever
- Reservoir/vector: Fruit bat
- Transmission:
  - Bat urine-contaminated food/water
  - Pigs as amplifier host (essential in life cycle)
  - Human secretions
- High mortality rate



BIG QUESTION 2: What are the Picornaviruses, their clinical syndromes, and diagnostic methods?

Broad Answer:

- Picornaviruses are small, non-enveloped RNA viruses that include Enteroviruses (Polio, Coxsackie, Echovirus, Enterovirus) and Rhinovirus.
- Enteroviruses spread via the feco-oral route and cause systemic and neurological diseases, while Rhinoviruses spread by inhalation and cause the common cold.
- Diagnosis involves throat/stool samples and PCR-based methods.

DETAILED QUESTIONS

Q2.1: What viruses are included in the Picornaviridae family and their transmission routes?

Answer:

Group	Members	Route
Enterovirus	Polio, Coxsackie (A, B), Echovirus, Enterovirus	Feco-oral
Rhinovirus	Common cold viruses	Inhalation

- **Attachment receptor for Rhinovirus: ICAM-1**

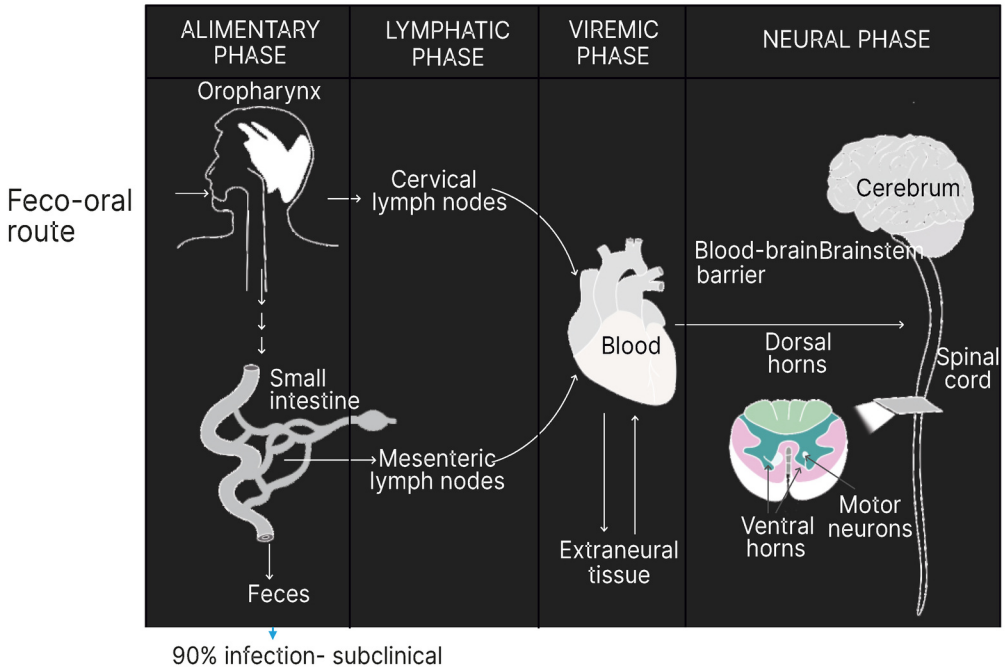
Q2.2: What is the pathogenesis and clinical course of Poliovirus infection?

Answer:

- Paralysis: Descending flaccid paralysis
- Phases of infection:
  - Alimentary phase: Initial replication in GIT

- Lymphatic phase: Spreads to cervical & mesenteric lymph nodes
- Viremic phase: Virus enters bloodstream
- Neural phase: Reaches spinal cord → causes paralysis

- Lab Diagnosis:
  - Samples: Throat swab, rectal swab, or fecal sample
  - Sewage sample: For epidemiological surveillance
  - Isolation is rare



Q2.3: What are the features of Coxsackie viruses A and B?

Answer:

Coxsackie A	Features	Coxsackie B
1-24	Serotypes	1-6
• Hand-Foot-Mouth Disease • Herpangina • Acute hemorrhagic conjunctivitis (A24, also Enterovirus 70)		• Hand-Foot-Mouth Disease • Bornholm Disease/ Devil's Grip/ Epidemic myalgia / Pleurodynia • Carditis

BIG QUESTION 3: What is the structure, pathogenesis, and diagnosis of Rabies virus?

Broad Answer:

- Rabies virus, a member of the *Rhabdoviridae* family (genus *Lyssavirus*), is a neurotropic virus transmitted through bites.
- It replicates in muscle, spreads via retrograde axonal transport to the CNS, and forms Negri bodies in neurons.
- Diagnosis involves antigen detection, and specimens include nape hair follicles.

DETAILED QUESTIONS

Q3.1: What is the classification and genus of the Rabies virus?

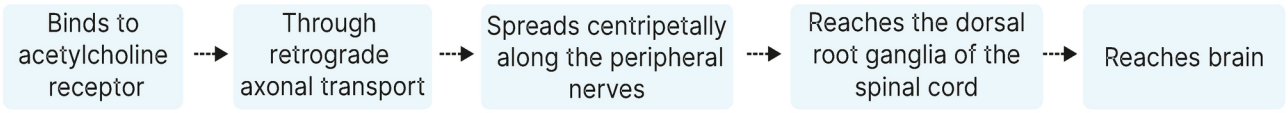
Answer:

- Family: Rhabdoviridae
- Genus: Lyssavirus
- Other genus: Vesiculovirus (e.g., Vesicular stomatitis virus)

Q3.2: What is the replication site and spread pattern of Rabies virus?

Answer:

- Replication site: Muscle (initial)
- Attachment: Acetylcholine receptor
- Spread:
  - Retrograde axonal transport via peripheral nerves
  - Reaches dorsal root ganglia, then brain (centripetal spread)
  - Then spreads centrifugally to cornea, salivary glands, nerves, etc.
- Speed of spread in axons: ~3 mm/hour
  - Faster in:
    - → Children
    - → Upper limb bites
    - → Shorter stature individuals



Q3.3: What are the hallmark histopathological findings in Rabies?

Answer:

- Negri bodies:
  - Seen in hippocampus and cerebellum
  - Staining: Seller's stain

Q3.4: What is the laboratory diagnosis of Rabies?

Answer:

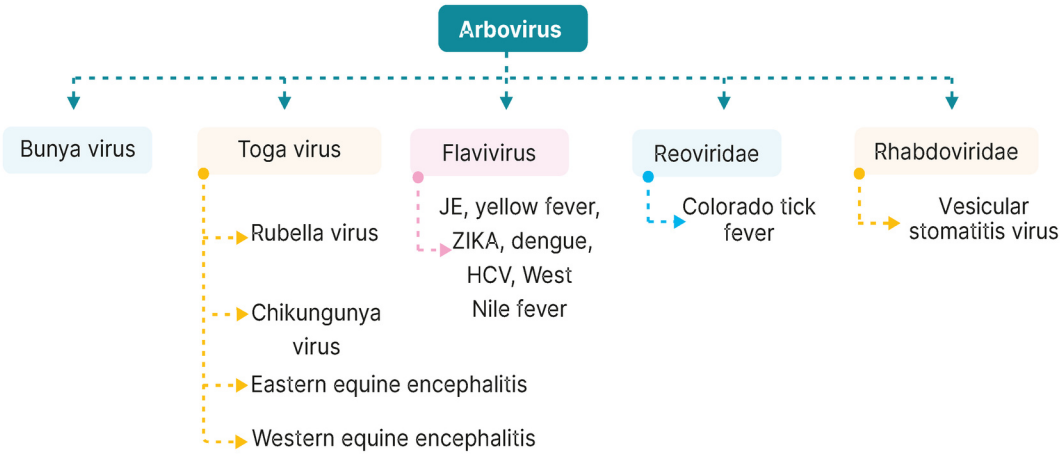
- Best specimen: Hair follicles from nape of the neck (most sensitive)
- Test: Antigen detection by direct immunofluorescence

BIG QUESTION 4: What are the major Arboviruses and their clinical, epidemiological, and preventive features?

Broad Answer:

- Arboviruses (arthropod-borne viruses) include *Flavivirus*, *Togavirus*, *Bunyavirus*, *Reoviridae*, and others.
- Transmitted by vectors like Aedes and Culex mosquitoes, they cause diseases such as Dengue, Zika, Chikungunya, Japanese encephalitis, and Yellow fever.
- Diagnosis is clinical and serological, with vaccines available for some.
- Certain tick-borne and bat-associated viruses like KFD and Marburg are also included.

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DETAILED QUESTIONS

Q4.1: What are the major families and examples of Arboviruses?

Answer:

Family	Examples
Flavivirus	Dengue, Zika, Japanese encephalitis, Yellow fever, West Nile virus, HCV
Togavirus	Rubella (now in Matonaviridae), Chikungunya, Eastern/Western Equine Encephalitis
Bunyavirus	Rift Valley fever, California Encephalitis
Reoviridae	Colorado tick fever
Rhabdoviridae	Vesicular stomatitis virus

Q4.2: What are the Aedes-borne arboviruses and their features?

Answer:

- Eastern Equine Encephalitis, Zika, Chikungunya, Rift valley, Yellow, Dengue
- Vector: Aedes aegypti
- **Dengue:**
  - Serotypes: DEN-1 to DEN-4 (Most dangerous: DEN-2)
  - DEN-5: Found in Bangkok (2013)
  - Key feature: Platelet drop, hemoconcentration (↑ hematocrit) due to plasma loss
  - Lab diagnosis:
    - → NS1 antigen (early)
    - → IgM MAC-ELISA
    - → PCR
- **Chikungunya:**
  - Symptoms: Fever with migratory arthritis
  - Chik sign: Post-recovery hyperpigmentation
- **Zika virus:**
  - Transmission: Mother-to-child, sexual, blood
  - Teratogenicity:
    - → Stored in Hofbauer cells of placenta (macrophages)
    - → Causes microcephaly, congenital glaucoma, optic neuropathy

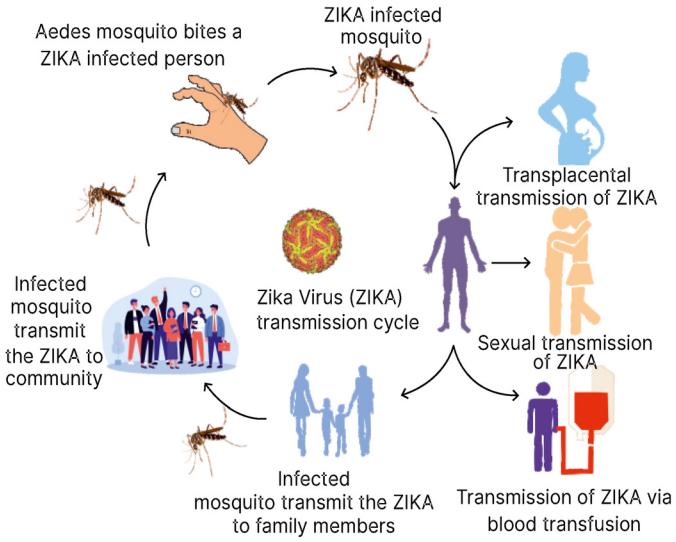
PYQ: NEET PG 2023



Chik sign

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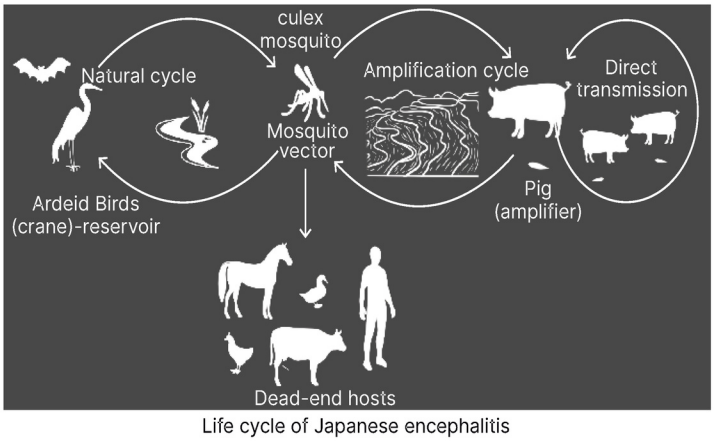
- Symptoms in mother: Myalgia, arthralgia, maculopapular rash, GBS PYQ: FMGE 2020 PYQ: NEET PG 2020



Q4.3: What are the Culex-borne arboviruses and their features?

Answer:

- Vector: Culex mosquitoes
  - Japanese Encephalitis (JE)
  - Reservoirs - ardeid birds
    - → Amplifier: Pigs
    - → Vector:
  - *Culex tritaeniorhynchus* (worldwide)
  - *Culex vishnui* (India)
    - → Vaccines:
  - Live attenuated: SA 14-14-2 (common in India)
  - Inactivated: Nakayama, Beijing P1
  - JENVAC: Killed vaccine (Kolar strain), IM, 2 doses at 9 months and 16-24 months PYQ: NEET PG 2019



Life cycle of Japanese encephalitis

  - West Nile fever and Bancroftian filariasis: Also spread by Culex

Q4.4: What are the features of Yellow Fever virus?

Answer:

- Vector: Aedes aegypti
- Symptoms: Hepatic jaundice

- Cytopathic effect: Torres bodies
- India status: Yellow fever-free
  - o Quarantine for unvaccinated travelers from endemic areas for 6 days
  - o Aedes index <1 around airports/seaports required
- Vaccine:
  - o 17D vaccine (Live attenuated)
    - → C/I: Immunocompromised, egg allergy (prepared from allantoic cavity)
    - → Validity: Certificate issued within 10 days; valid lifelong
- Serology
  - o IgM (early)
  - o IgG (late)

Q4.5: What is Kyasanur Forest Disease (KFD)?

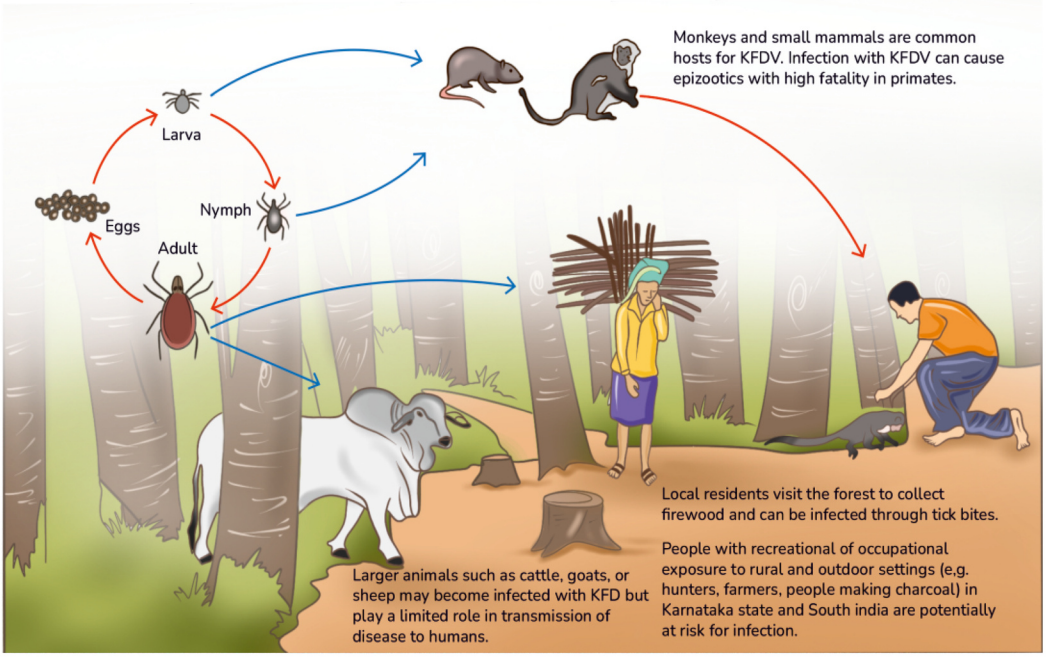
Answer:

- AKA: Monkey fever
- Vector: Hard tick
- IP: 4-8 days
- Amplifier host: Monkey
- Transmission: Tick bite/contact (No human-to-human spread)

The hard tick Haemaphysalis spinagera is the reserve and vector of Kyasanur forest Disease virus (KFDV), Once infected, ticks remain so for life and are able to pass KFDV to offspring via the egg.

Transmission of KFDV to humans may occur after a tick bite or contact with an infected animal, most commonly a sick or recently dead monkey, No person to person transmission has been described.

Human cases occur more frequently in drier months (Nov-june) and in southwest and south india.



Q4.6: What are the characteristics of Rotavirus?

Answer:

- Family: Reoviridae
- Shape: Wheel-like
- Most common cause of diarrhea in children
- Transmission: Feco-oral
- Toxin: NSP4 (enterotoxin)

- Diagnosis: Antigen detection, PCR (sample: stool)
- Genome: Double-stranded RNA (only such virus)
- Vaccines:
  - Rotateq
  - Rotarix
  - Side effect: Intussusception (A/w Peutz Jehgar's polyp)

Q4.7: What are the incubation periods of Arbovirus members?

Answer:

Dengue	5 to 6 days
Chikungunya	5 to 6 days
Japanese encephalitis	5 to 15 days
Yellow fever	3 to 6 days
KFD	4 to 8 days

BIG QUESTION 5: What are the structural and clinical features of HIV and HTLV?

Broad Answer:

- HIV and HTLV are retroviruses. HIV-1 is the predominant type in India.
- The virus contains structural genes (env, gag, pol) and infects CD4+ cells using CCR5/CXCR4 co-receptors.
- Disease progression correlates with CD4 count decline.
- Laboratory diagnosis involves 4th-generation assays and confirmatory Western blot.
- HTLV, especially HTLV-1, causes adult T-cell leukemia/lymphoma and spastic paraparesis.

DETAILED QUESTIONS

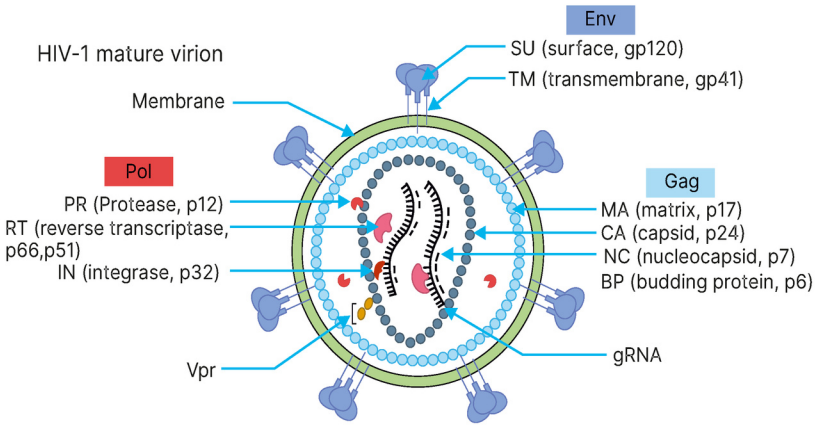
PYQ: FMGE 2021

Q5.1: What are the types and structure of HIV?

Answer:

- Retroviruses: HIV-1 and HIV-2
  - HIV-1 is more common
  - Group M, Serotype C is predominant in India
- Structural genes and their products:

Gene	Protein Components	Function
env	gp160 → gp120 (surface), gp41 (transmembrane)	Attachment, entry
gag	p17 (matrix), p24 (capsid), p7 (nucleocapsid), p6	Structure, budding
pol	p12 (protease), p66/p51 (reverse transcriptase), p32 (integrase)	Enzymatic activity

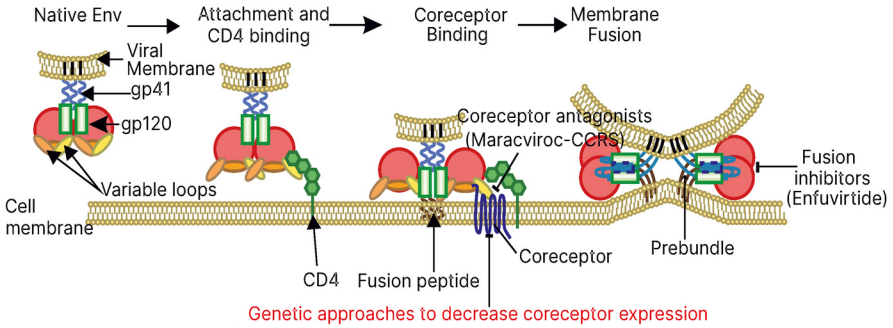


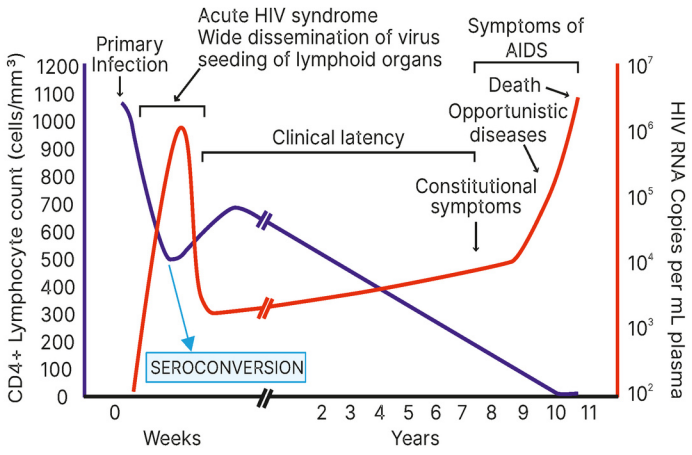
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Q5.2: What is the HIV life cycle and pathogenesis?

Answer:

- Attachment: gp120 binds to CD4 and co-receptors:
  - CCR5 (macrophages)
  - CXCR4 (T-cells)
- TMPRSS2: Activates spike protein (for SARS-CoV-2; not involved in HIV)
- Entry → Reverse transcription → Integration (by integrase)
- CD4 decline phases:
  - Acute HIV syndrome → CD4 drop
  - Clinical latency (asymptomatic, but active replication)
  - Opportunistic infections begin as CD4 declines





Q5.3: What are the opportunistic infections associated with CD4 count decline?

Answer:

CD4 Count	Opportunistic Infections
~600	Lymphadenopathy
~500	Herpes zoster, Pneumococcus (lobar pneumonia)
~400	Kaposi's sarcoma (can occur at any CD4 count)
~300	Oral hairy leukoplakia, TB (snowstorm/hazy radiology)
<200	PCP (perihilar opacities), Miliary TB, Candida, Cryptosporidium
<100	Cerebral toxoplasmosis, Cryptococcal meningitis, CNS lymphoma, HIV dementia, PMLE
<50	CMV retinitis, MAC

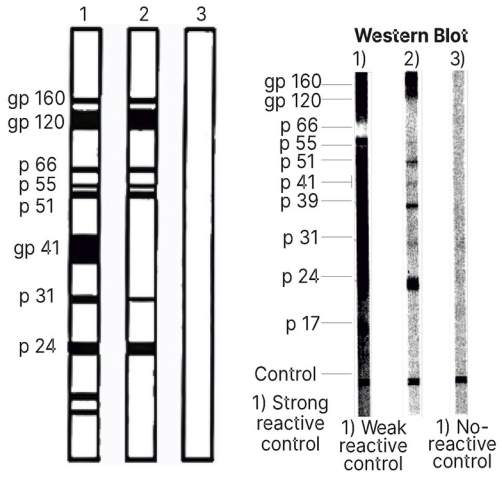
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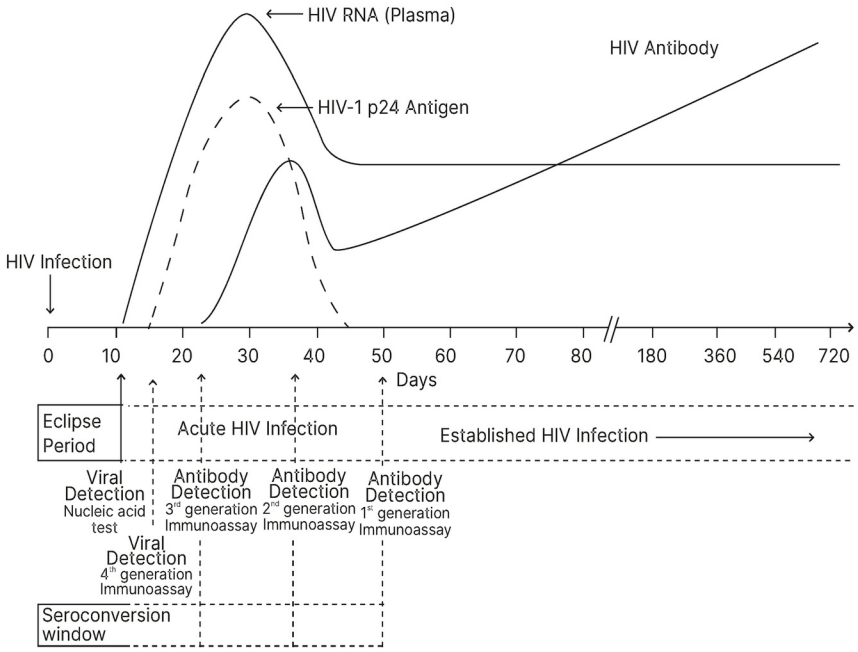
Q5.4: What are the diagnostic methods for HIV?

Answer:

- Screening:
  - 4th-generation assay: Detects both p24 antigen and antibodies
- Confirmatory:
  - Western Blot
    - → WHO Criteria: Antibodies against 2 env proteins ± gag/pol
    - → CDC Criteria: Any 2 bands (p24, gp160, gp120, gp41)



- Earliest test: HIV RNA plasma (e.g., for needle stick injuries)



Q5.5: What is HTLV and its clinical relevance?

Answer:

- Full form: Human T-cell Leukemia Virus (HTLV)
- Gene: TAX gene
- Diseases caused:
  - ATLL (Adult T-cell Leukemia Lymphoma)
  - Tropical Spastic Paraparesis (TSP)

- Transmission:
  - Blood
  - Body fluids
  - Breast milk
- Microscopy: Cloverleaf cells

BIG QUESTION 6: What are the features and diagnostic approaches for Filoviruses like Ebola and Marburg?

Broad Answer:

- Filoviruses like Ebola and Marburg cause severe viral hemorrhagic fevers with high fatality.
- Bats are the primary reservoirs.
- Ebola virus spreads via contact with body fluids.
- Diagnosis includes clinical suspicion, epidemiological context, and RT-PCR.
- Vaccines and monoclonal antibodies like Inmazeb are available for Ebola.
- Ecology involves enzootic and epizootic cycles in non-human primates and bats.

DETAILED QUESTIONS

Q6.1: What are the key features of the Ebola virus?

Answer:

- Family: Filoviridae
- Shape: Filamentous - "bowl of spaghetti" appearance
- Reservoir host: Bats
- Transmission:
  - Direct contact with body secretions
  - Patient-to-patient contact
- Most virulent strain: Zaire Ebola
- Least virulent strain: Ivory Coast
- Reston strain: Non-pathogenic to humans
- Incubation period: 3-15 days
- Diagnosis: RT-PCR
- Cytopathic effect (CPE): Typical for hemorrhagic viruses
- Treatment:
  - Inmazeb (monoclonal antibody cocktail)
  - Zaire vaccine (available)

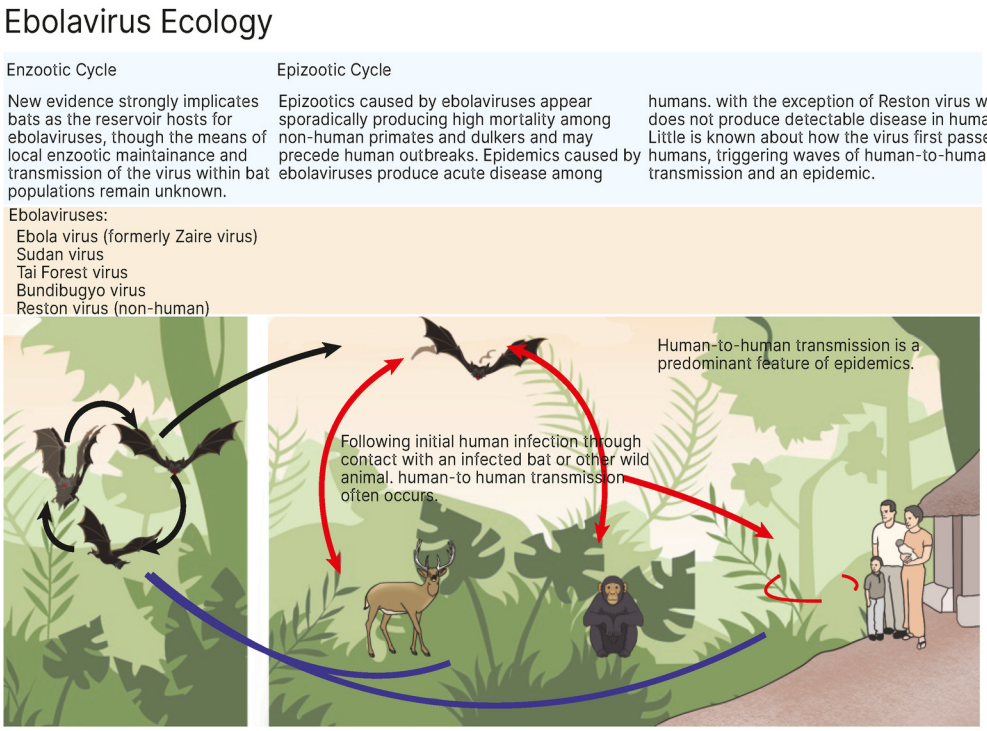


Q6.2: What is the ecology of Ebola virus transmission?

Answer:

- **Enzootic Cycle:**
  - Maintained in bats
  - Transmission among bats is unclear
  - Occurs silently in nature
- **Epizootic Cycle:**
  - Outbreaks in non-human primates and duikers

- Often precede human outbreaks
- Transmission to humans triggers epidemics
- Reston strain: Causes outbreaks in animals but not humans



Q6.3: What is the Marburg virus and its features?

Answer:

- Family: Filoviridae
- Disease: Hemorrhagic fever
- Clinical presentation: Similar to Ebola
- Reservoir host: Likely bats
- Diagnosis: RT-PCR
- No specific vaccine or monoclonal therapy available yet

BIG QUESTION 7: What is the virology, diagnostic strategy, and antiviral treatment for COVID-19 and other RNA viruses?

Broad Answer:

- SARS-CoV-2 is a beta-coronavirus that causes COVID-19.
- It binds to ACE2 receptors via spike protein activated by TMPRSS2.
- Diagnostic strategies include RT-PCR, antigen testing, and serology.
- CT findings show ground-glass opacities and halo signs.
- Other RNA viruses like HSV, CMV, and RSV have specific antivirals.

DETAILED QUESTIONS

Q7.1: What is the virology and structural mechanism of SARS-CoV-2 (COVID-19)?

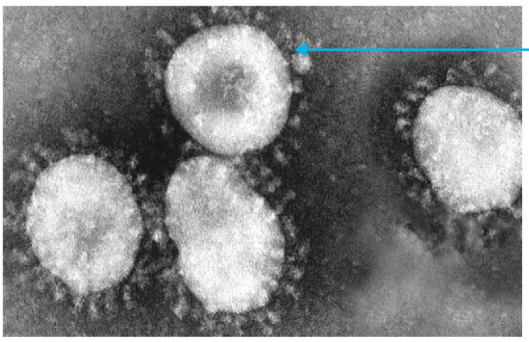
PYQ: FMGE 2018,2021

Answer:

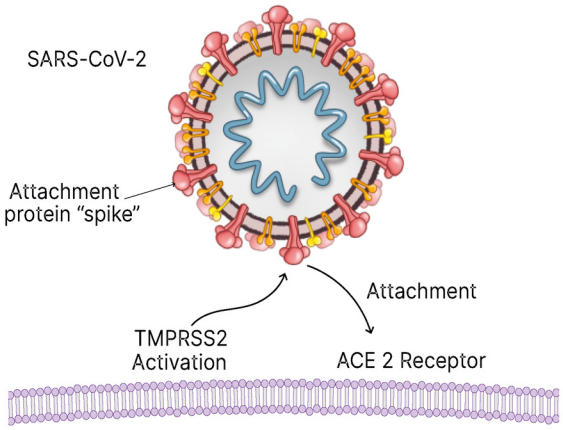
- Family: Coronaviridae

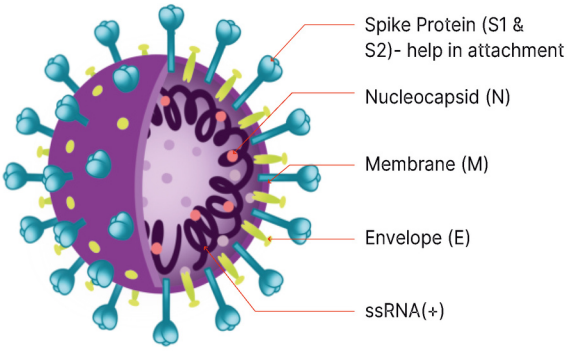
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- Genus: Beta-coronavirus
- Morphology: Crown-like structure with petal-like peplomers (seen under EM)
- Attachment protein: Spike protein
  - Activated by TMPRSS2
  - Binds to ACE2 receptor
- Transmission: Respiratory droplets, contact, fomites



Electron microscope appearance

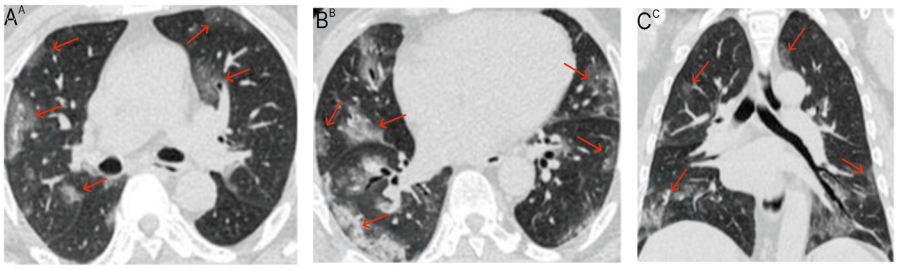




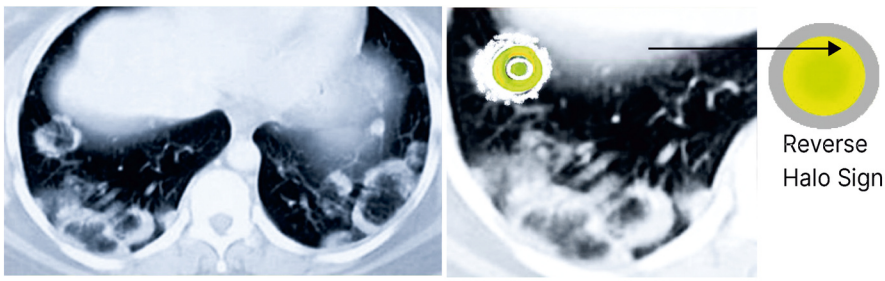
Q7.2: What are the clinical features and radiological findings of COVID-19?

Answer:

- Symptoms:
  - Fever
  - Dry cough
  - Dyspnea, shortness of breath
  - Loss of smell and taste
  - GI symptoms: nausea, vomiting, pain, diarrhea
  - Myalgia
- Radiology:
  - Multifocal ground-glass opacities (GGO)

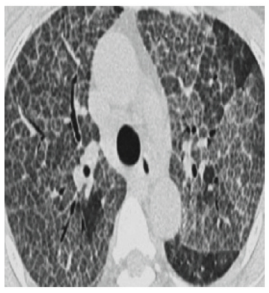


  - Consolidation
  - Halo sign / Atoll sign / Reverse halo sign



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- Crazy paving pattern

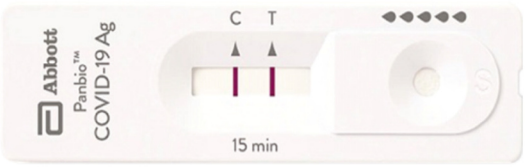


Q7.3: What are the diagnostic strategies for COVID-19?

Answer:

- Sample collection:
  - Nasopharyngeal + Oropharyngeal swabs in VTM
- RT-PCR (Real-Time Reverse Transcriptase PCR):
  - Gold standard
  - Lower CT (cycle threshold) value → higher infectivity
- Target genes:
  - Screening genes: E gene, N gene, S gene
  - Confirmatory genes: RdRP gene, ORF1a gene
- Card test / Rapid test:
  - Immunochromatography (ICT) principle
  - Control band indicates validity
  - Result: Positive / Negative





Q7.4: What are the antiviral drugs used for other RNA viruses?

Answer:

- HSV-1, HSV-2, VZV:
  - Acyclovir
  - Resistance: Cidofovir (better) or Foscarnet
- CMV:
  - Ganciclovir
  - Resistance: Cidofovir (better) or Foscarnet
- CMV Retinitis:
  - Intravitreal Ganciclovir
  - Resistance: Cidofovir or Foscarnet
- Smallpox (eradicated)
  - Brincidofovir
- Monkeypox:
  - Tecovirimat (TPOXX)
- Influenza:
  - Neuraminidase inhibitors:
    - → Oseltamivir (oral)
    - → Zanamivir (nasal)
    - → Peramivir (IV)
  - M2 inhibitors:
    - → Amantadine
    - → Rimantadine
- RSV:
  - DOC: Ribavirin
  - Prophylaxis: Palivizumab

6. MYCOLOGY

BIG QUESTION 1: Describe the classification of fungi based on morphology in brief.

Broad Answer:

Fungi are morphologically classified into **yeasts**, **moulds**, and **dimorphic fungi**. **Yeasts** are unicellular, round or oval organisms that reproduce by budding, while **moulds** are multicellular with filamentous hyphae. **Dimorphic fungi** can exist as yeasts at body temperature (37°C) and as moulds at room temperature (25°C), depending on environmental conditions.

DETAILED QUESTIONS

Q1.1: What are the structural components in the cell wall and membrane of a fungus?

Answer:

- Structure:
  - o Cell wall:
    - → Chitin
  - o Cell membrane:
    - → Ergosterol

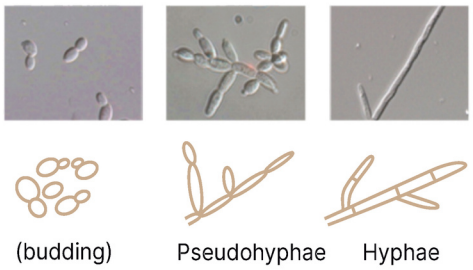
Q1.2: Which fungi lack ergosterol?

Answer: Pneumocystis.

Q1.3: Write a short note on the classification of fungi based on morphology.

Answer:

- Yeast - only buds - found in Cryptococcus
- Yeast-like - bud and pseudohyphae - Candida and Malassezia
- Moulds / Hyphae
- Dimorphic fungus



Q1.4: Tabulate the differences between yeast and mould form.

Answer:

Can occur in the form of YEAST	Can occur in the form of mold
• Forms at heat • 37°C	• Forms at cold • 22-25°C

Q1.5: Name the dimorphic fungi.

Answer:

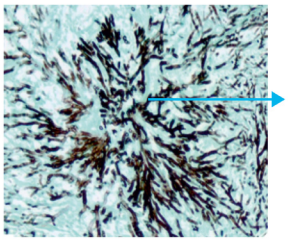
- Dimorphic Fungus
  - o Mnemonic- Body Heat Probably Changes Shape

Body	Blastomyces
Heat	Histoplasma
Probably	Penicillium Marnefffi, paracoccidioidomycosis
Changes	Coccidioidomycosis
Shapes	Sporothrix schenckii

Q1.6: Name the stains used in mycology.

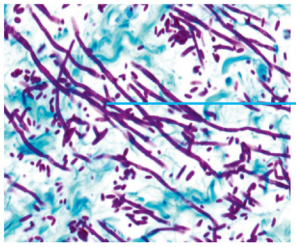
PYQ: FMGE 2020

Answer:



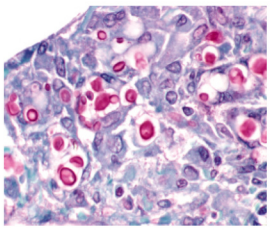
Black color hyphae

Gomori methenamine silver (Black hyphae)

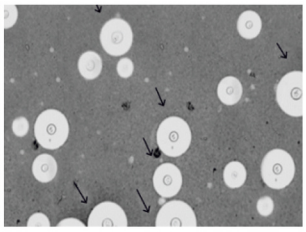


Pink color hyphae

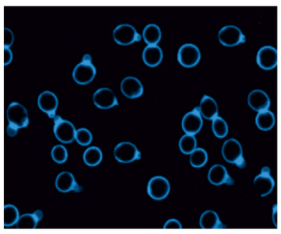
PAS (Pink Hyphae)



Mucicarmine (Cryptococcus on biopsy)



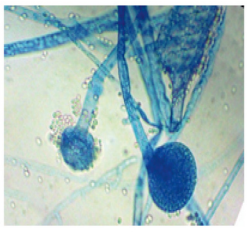
India ink/Nigrosin/ (Cryptococcus on CSF)



Calcofluor, white



SDA



Lactophenol cotton blue

Q1.7: What is the culture medium used for cultivating fungi, and describe the stain used to appreciate the culture morphology?

Answer:

- SDA - Sabouraud dextrose agar(PH 5.6) - culture media contains gentamicin and chloramphenicol
- Culture morphology - the stain used is Lactophenol cotton blue (LPCB) also contains glycerol (hydration).

Q1.8: Describe the classification of fungi based on location.

Answer:

- Superficial mycosis
  - Tinea versicolor/Malassezia furfur
  - Dermatophytes
- Subcutaneous mycosis
  - M - Mycetoma
  - R - Rhinosporidiosis
  - C - Chromoblastomycosis
  - S - Sporotrichosis
- Deep mycosis/ systemic mycosis

BIG QUESTION 2: Write briefly about superficial mycosis.

Broad Answer: **Superficial mycosis** are fungal infections limited to the outermost layers of the skin, hair, and nails, such as **tinea versicolor** and **piedra**, and they typically cause cosmetic issues without significant inflammation.

DETAILED QUESTIONS

Q2.1: Name the organisms causing superficial mycosis.

Answer:

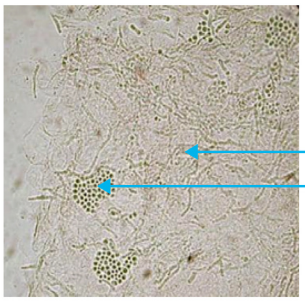
- **Superficial mycosis**
  - Tinea versicolor/Malassezia furfur
  - Dermatophytes

Q2.2: Write a short note on Tinea versicolor.

PYQ: FMGE 2021

Answer:

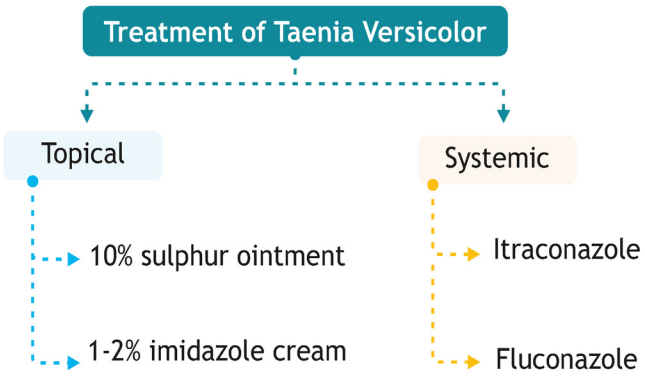






Fried Egg Colonies

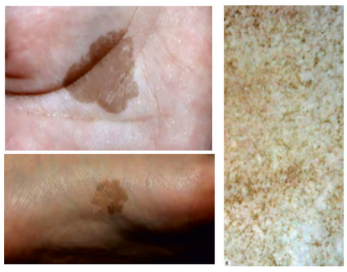
- Lesions - hypopigmented
- 10% KOH - for digesting keratin while doing skin scraping
- Culture - Spaghetti and meatballs appearance or banana and grapes appearance.
- Culture media used - SDA with olive oil
  - The organism is lipophilic
  - Fried egg appearance
  - Bacteria: Mycoplasma also shows a Fried egg appearance



Q2.3: Write a short note on Tinea nigra.

Answer:

- Brown patches on palms and soles
- Hortaea Werneckii
- Treatment - **topical imidazole**



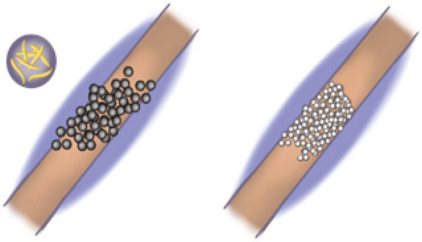
Q2.4: Name the two types of peidra.

Answer:

- Black piedra
  - Piedraia hortae

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- White piedra
  - o Trichosporon Beigelli(Bijli)



Black Piedra White Piedra

Q2.5: What is the treatment for Piedra?

Answer:

- Topical imidazole
- Cut/shave the hair

BIG QUESTION 3: Write a short note on Dermatophytes.

Broad Answer: Dermatophytes are a group of keratinophilic fungi that infect the skin, hair, and nails, causing superficial fungal infections known as **tinea** or **ringworm**. They belong to three main genera: **Trichophyton**, **Microsporum**, and **Epidermophyton**. These fungi thrive in warm, moist environments and spread through direct contact with infected individuals, animals, or contaminated surfaces.

DETAILED QUESTIONS

Q3.1: Name the 3 types of dermatophytes.

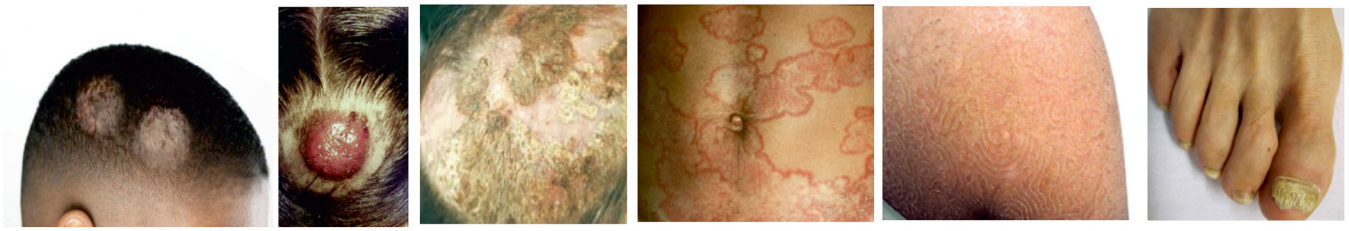
Answer:

- Aka Tinea/ ringworm
  - o Trichophyton - Involves **Skin, Hair** and **Nails**
  - o Microsporum - Involves **Skin** and **Hair**
  - o Epidermophyton - Involves **Skin** and **Nails**

Q3.2: Name the tinea found in different parts of the body.

Answer:

PYQ: NEET PG 2021



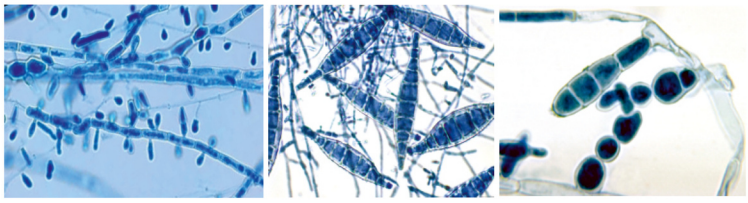
Tinea Capitis Kerion Tinea Favus Tinea Corporis Tinea Imbricata Tinea Unguium

When scalp is involved	Tinea capitis	Beard infections	Tinea barbae
When scalp shows crust	Tinea favus / Scutula (T.Schonleinei)	Face	Tinea faciei
Soft Boggy swelling	Kerion	Groin - dhobi itch / jock itch	Tinea cruris
Fungal infection on trunk	Tinea Corporis (on trunk)	Nail bed	Tinea unguium
Concentric pattern on the trunk	Tinea Imbricata	Feet involvement (athlete foot)	Tinea pedis

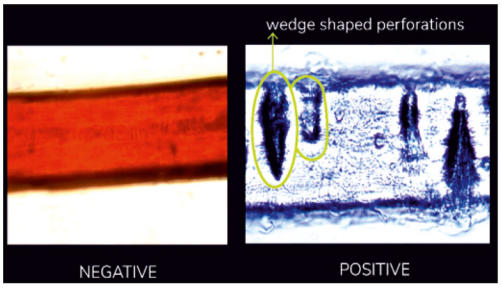
Q3.3: How will you differentiate the dermatophytes based on their macro- and microconidia?

Answer:

Organism(TME)	Macroconidia(PSC)	Microconidia
Trichophyton	Pencil shaped +	++++ (maximum)
Microsporum	Spindle shaped ++	++ (moderate)
Epidermophyton	Club shaped ++++	+ (minimum)



Q3.4: What is the hair perforation test, and what is it used for?



Answer:

- Incubate hair with yeast and fungus for 2-3 weeks
- To differentiate between T. rubrum and T. mentagrophytes
- Mentagrophytes show hair shaft erosion

Q3.5: Write a short note on the treatment for Tinea.

Answer:

- Topical antifungal - azole derivatives
- Itraconazole/terbinafine
- Oral griseofulvin is the DOC for tinea capitis.

Q3.6: Write a short note on the Dermatophytides/ID Reaction.

Answer:

- Sterile lesions away from the original lesion
  - Probably due to fungal products
  - Can be followed by antifungal therapy as well.

BIG QUESTION 4: Write briefly about subcutaneous mycosis.

Broad Answer: Subcutaneous mycosis refers to fungal infections that affect the deeper layers of the skin, subcutaneous tissue, and sometimes bone, usually following traumatic implantation of the fungus. Common examples include **mycetoma**, **sporotrichosis**, **chromoblastomycosis**, and **rhinosporidiosis**. These infections typically progress slowly and may cause chronic nodules, ulcers, or discharging sinuses.

DETAILED QUESTIONS

Q4.1: Name the organisms causing subcutaneous mycosis.

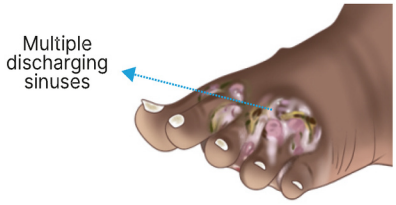
Answer:

- Subcutaneous mycosis:
  - **M** - Mycetoma

- **R** - Rhinosporidiosis
- **C** - Chromoblastomycosis
- **S** - Sporotrichosis

Q4.2: Tabulate the difference between Actinomycetoma and Eumycetoma.

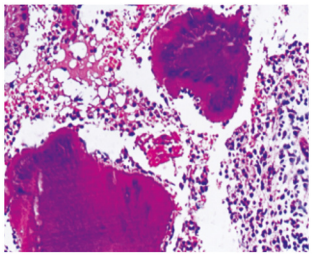
Answer:



Actinomycetoma	Features	Eumycetoma
Gram +ve filamentous bacteria	Organisms	Caused by fungus
Actinomadura madurae	Examples	Madurella mycetomatis
Actinomadura pelletieri - red colour granules off white/yellow granules o Nocardia o Streptomyces o Actinomadura	Granules	Brown: Madurella mycetomatis (melanin)
Cotrimoxazole with / without amikacin for 6-12 months	Treatments	Antifungals if failed: Amputation

Q4.3: Write a short note on sunray appearance.

Answer:



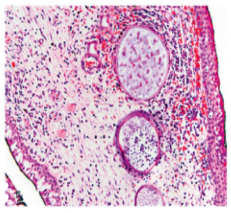
- Blue colour filaments
- Actinomycetoma gram +ve Filamentous
- Splendore-Hoeppli phenomenon (antigen-antibody complex) is also seen in Sporothrix schenckii

Q4.4: Write a short note on Rhinosporidiosis.

Answer:

Organism	**Rhinosporidium seeberi**
Classified as	Aquatic parasite
History	Swimming (South India)
Sites	Nasal cavity
Gross	Strawberry polyp
Microscopic	Sporangia with endospores
Appearance	Strawberry appearance
Culture	**Non-Cultivable Organisms**
Treatment	Surgery


Strawberry Nasal Polyp


Endospores appear inside sporangia

Q4.5: What is chromoblastomycosis?

PYQ: FMGE 2018,2019

PYQ: AIIMS, 2019,2021,2022

PYQ: AIIMS 2022

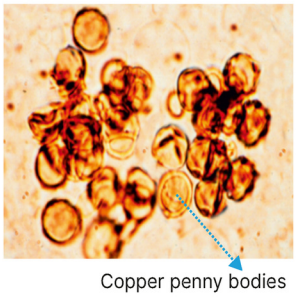
Answer:

- Also called Verrucous dermatitis
- Lesions - Warty development
- Diagnosis - Copper penny bodies/sclerotic/muriform/medlar bodies (mnemonic: MMS)

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Verrucous Dermatitis



Copper penny bodies

Organism	• Fonsecaea pedrosi and F. compacta • Exophiala • Phialophora • Cladophialophora
Route	• Traumatic: Barefoot walking
Treatment	• Wide surgical resection • Laser reduction if needed • Amphotericin B

BIG QUESTION 5: Write a short note on dimorphic fungi.

Broad Answer:

Dimorphic fungi are fungi that can exist in two different morphological forms depending on the temperature: as **moulds at room temperature (25°C)** and as **yeasts at body temperature (37°C)**. This temperature-dependent switch helps them survive in the environment as moulds and become pathogenic in humans as yeasts. Examples include **Histoplasma capsulatum**, **Blastomyces dermatitidis**, and **Coccidioides immitis**.

DETAILED QUESTIONS

Q5.1: Name the dimorphic fungi.

Answer:

- Histoplasma capsulatum
- Blastomyces dermatitidis
- Paracoccidioides brasiliensis
- Coccidioides immitis

Q5.2: What are the other names for Blastomyces?

Answer: Also known as - North American blastomycosis/Chicago/Gilchrist disease.

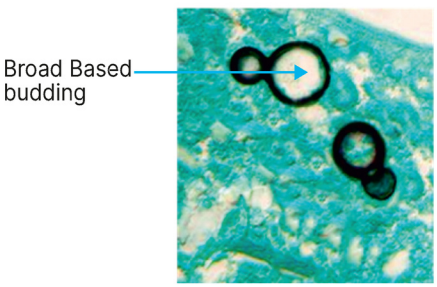
Q5.3: What is the characteristic feature of the yeast form of Blastomyces?

Answer: Identification - Forms an 8-shaped budding or B-shaped

Q5.4: What are the drugs given in the treatment of Blastomycosis?

Answer:

- Mild cases: **Fluconazole** or **itraconazole**
- Disseminated: **Amphotericin B** followed by **itraconazole**



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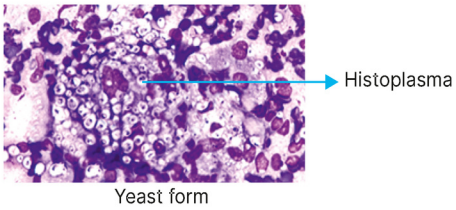
Q5.5: What are the other names for Histoplasmosis?

Answer: Also known as Ohio disease/Darling disease/Cave's disease.

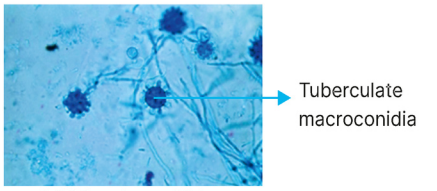
Q5.6: Write a short note on Histoplasmosis.

Answer:

- **Reticuloendotheliosis**, goes into the **macrophages.**
- Reservoir: **Bat/bird droppings**
  - Contaminated the soil and passed on to the humans
- Similar to TB
- Identification
  - Yeast form -2-4 microconidia
  - **Tuberculate Macroconidia** using the stain Lactophenol cotton blue



Yeast form



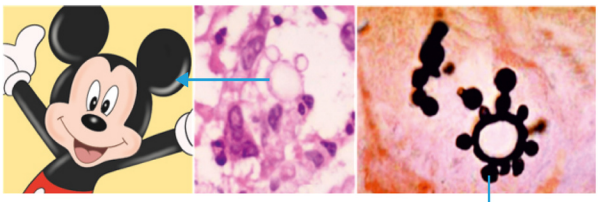
LPCB stain on SDA agar

Q5.7: Write a short note on Paracoccidioidomycosis.

PYQ: NEET PG 2022

Answer:

- Also known as South American Blastomycosis
- Pilot wheel appearance/Mariner wheel appearance
- Mickey Mouse appearance

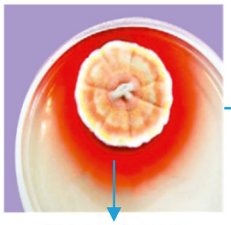

Mickey Mouse Appearance

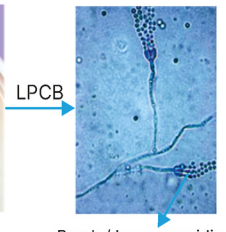
Pilot wheel/ Mariner wheel appearance

Q5.8: Write a short note on Penicillium marneffei.

Answer:

- Also known as Talaromyces marneffei
- Natural reservoir - bamboo rat
- LPCB will show a brush/broom-like structure
- A red pigment is produced.


Red color Pigment

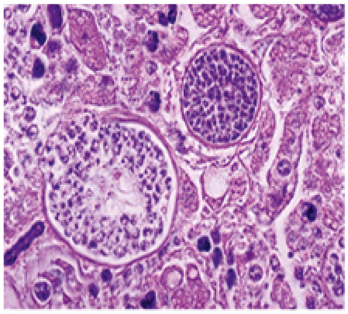


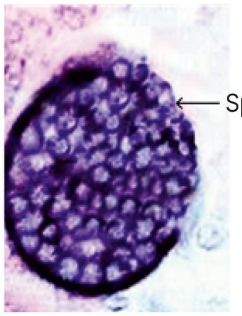
Brush / broom conidia

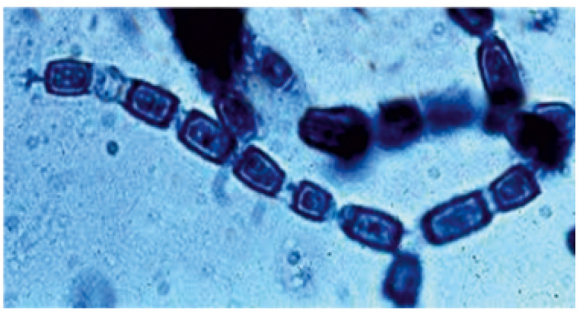
Q5.9: Write a short note on Coccidioidomycosis.

Answer:

- Also known as Desert Rheumatism/Valley fever/California disease.
- Shows joint involvement, hence rheumatism.
- Microscopic examination: Spherule with endospores.
- Spores - barrel-shaped arthrospores in LPCB stain.



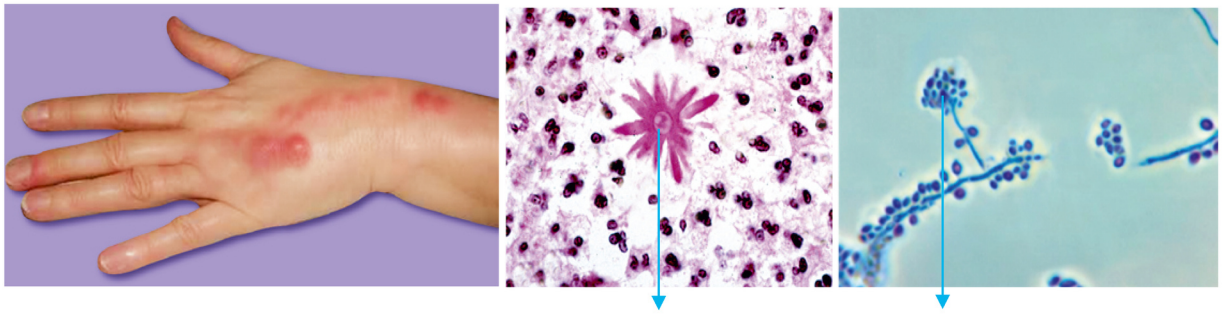




Q5.10: Write a short note on Sporotrichosis.

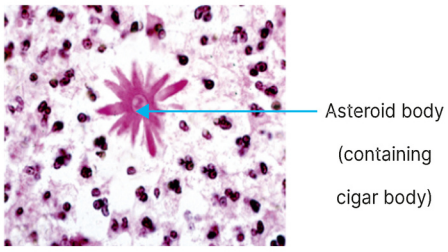
PYQ: FMGE 2023 PYQ: NEET PG 2020

Answer:



- Also known as rose gardener's disease / lymphocutaneous disease
  - The organism responsible is Sporothrix schenckii
  - Route: Traumatic penetration (rose thorn prick)
  - Nodules spread along lymphocytes
  - In the centre, there is a round-shaped cigar body and surrounding it, there are projections of fungus (splendore hoeppli), Ag-Ab reaction and together it is called the asteroid body
  - Rosettes of conidia are also seen.

PYQ: AIIMS 2020,2021



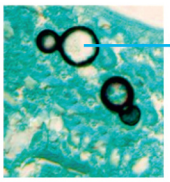
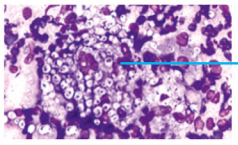
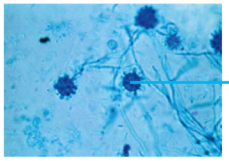
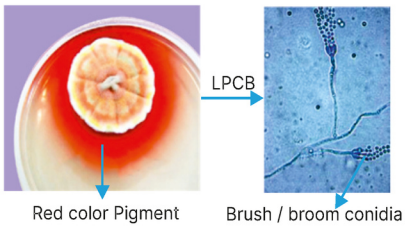
Q5.11: Where else are the asteroid bodies seen?

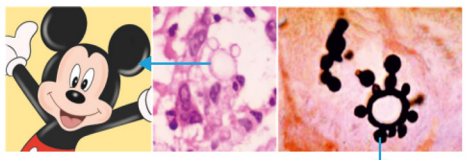
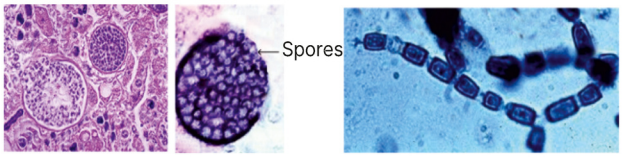
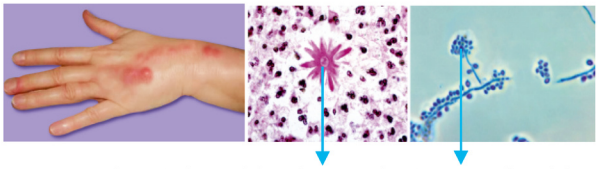
Answer:

- Extracellular - outside the cell - Sporothrix
- Intracellular - inside the cell - Sarcoidosis

Q5.12: Tabulate the different dimorphic fungi with their characteristics.

Answer:

Organism	Also known as	Image
Blastomyces	North American blastomycosis / gilchrist / chicago disease	• 8 shaped budding 
Histoplasmosis	Ohio, darling disease & Cave's Disease	• Yeast  • Tuberculate Macroconidia  LPCB stain on SDA agar
Penicillium marneffei	Talaromyces marneffei	• Red pigment and broom shaped 

Paracoccidioidomycosis	South American Blastomycosis	• PPMM - pilot wheel/mariner wheel /mickey mouse  Mickey Mouse Appearance Pilot wheel/ Mariner wheel appearance
Coccidioidomycosis	Desert rheumatism/ Valley fever & California Disease	• Barrel shaped - arthrospores  Spores
Sporothrix Schenckii	Rose gardener disease	• Lymphatic spread • Cigar body and asteroid body seen  Asteroid body (containing cigar body) Rosettes of conidia

BIG QUESTION 6: Write a short note on opportunistic infections.

PYQ: FMGE 2023

Broad Answer: Opportunistic infections are infections caused by organisms that typically do not cause disease in healthy individuals but can lead to serious illness in those with weakened immune systems. Common pathogens include **Candida**, **Aspergillus**, **Cryptococcus**, and **Pneumocystis jirovecii**. These infections often occur in patients with **HIV/AIDS**, cancer, organ transplants, or those receiving immunosuppressive therapy.

DETAILED QUESTIONS

Q6.1: Tabulate the difference between Cryptococcus neoformans and C. gatti.

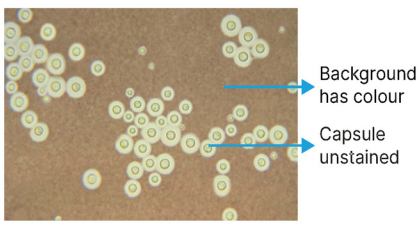
Answer:

Neoformans	Features	Gatti
Around the world	Distribution	Tropical, subtropical
Soil with pigeon droppings	Isolation	Soil around eucalyptus tree
Immunodeficient people (HIV)	Immunity	Immunodeficient + Immunocompetent
Good responses to antifungal	Treatment	Prolonged treatment

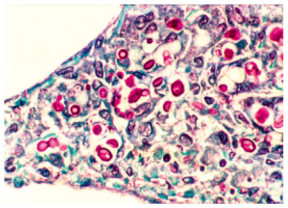
Q6.2: Write a short note on the type of sample taken, culture medium, stain used for biopsy and confirmatory test for cryptococcal meningitis.

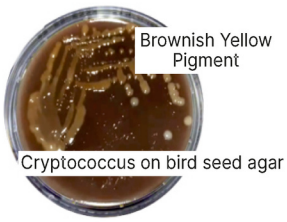
PYQ: FMGE 2019

Answer:



CSF- Negative Stain


Biopsy: Mucicarmine



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- Sample taken - CSF
- The stain used is India ink or Nigrosin (negative staining)
- The capsule is unstained
- Brain biopsy - Mucicarmine
- Brownish - Bird seed/Niger seed agar because of enzymes called **Phenol Oxidase** or **Laccase**
- Confirmatory test is **Lateral flow assays> latex agglutination test**

Q6.3: What is the treatment for cryptococcal meningitis?

Answer: Liposomal amphotericin B with flucytosin.

Q6.4: Write briefly about Candida species and their antibiotic resistance.

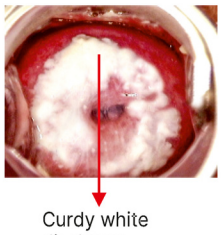
PYQ: FMGE 2020

PYQ: NEET PG 2022

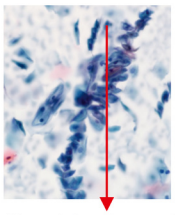
Answer:

- Yeast like
  - Candida albicans
  - Candida dubliniensis
  - Candida glabrata- no pseudohyphae
  - Candida auris- resistant to azoles
  - Candida krusei- resistant to azoles
  - Candida kefyr- control in susceptibility tests

    → Curdy white discharge



Curdy white discharge



Pseudohyphae and epithelial cells

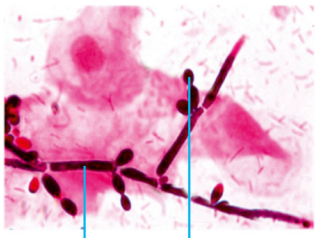
Q6.5: What is the characteristic appearance of Candida on PAP smear?

Answer: On PAP smear - Sheesh Kebab effect.

Q6.6: What are the other characteristic features of Candida

Answer:

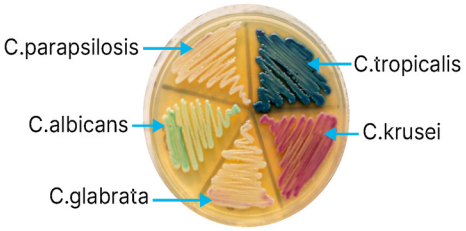
- Budding and pseudohyphae (Cells in a line)
- Candida grown on agar - creamy/pasty/yeasty in SDA
- CHROM agar is used
- Candida will form chlamydospores on **Corn Meal Agar**
- Germ tube test - keep Candida with growth factor - **Reynold Braude Phenomenon**

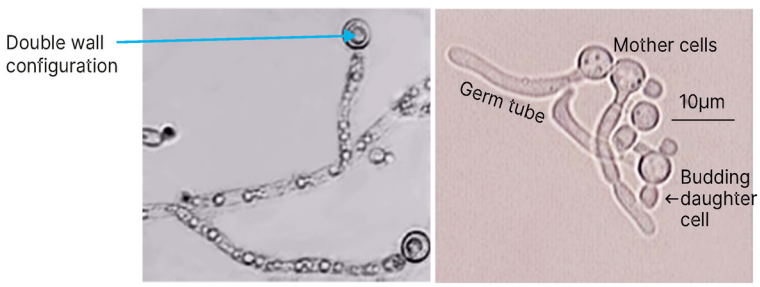


Pseudohyphae Buds



SDA





Chlamydospores

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Q6.7: Tabulate the differences between Candida albicans and Candida dubliniensis.

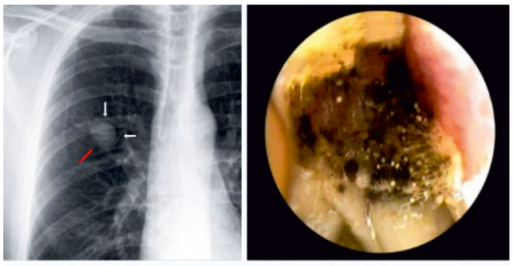
Answer:

Candida albicans	Features	Candida dubliniensis
Positive	Germ tube test	Positive
Positive	Chlamydospores	Positive
Positive	Growth above 45 degrees	Negative
Positive	Growth in hypertonic saline	Negative

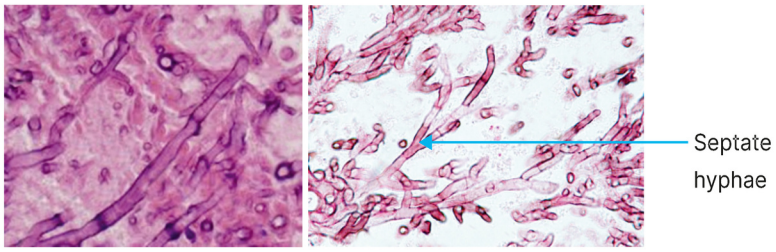
Q6.8: Write a short note on Apergillus.

PYQ: FMGE 2023 PYQ: AIIMS 2021

Answer:



Aspergilloma Superficial-Otomycosis



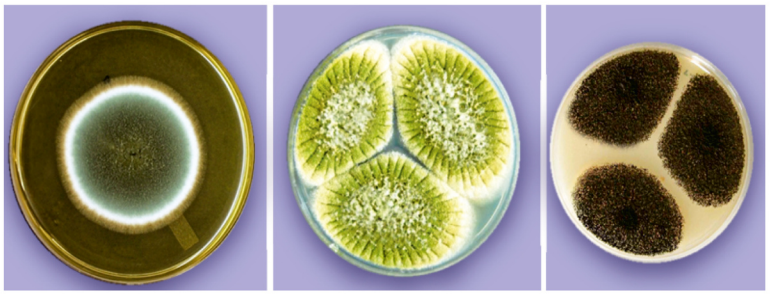
Acute angle dichotomous branching

- A- Acute angle branching less than 90
- SPE - Septate - Presence of septa - Dichotomous branching

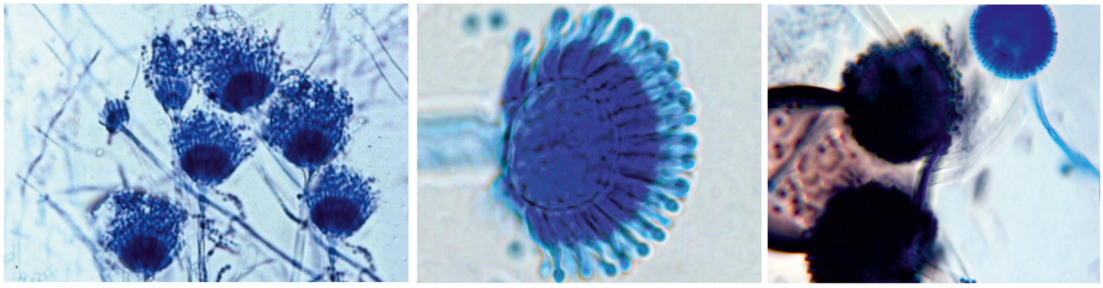
Q6.9: Tabulate the difference between A. fumigatus, A. flavus, and A. niger.

Answer:

Fumigatus	**Flavus**	**Niger**
• Smoky green colour • Conidia present along the upper part of the vesicle	• Like colour of different flowers - green & yellow • Conidia all over	• It is black in colour



A.fumigatus A. flavus A.niger



Q6.10: Write a short note on Aflatoxin, which causes Hepatocellular Carcinoma.

Answer:

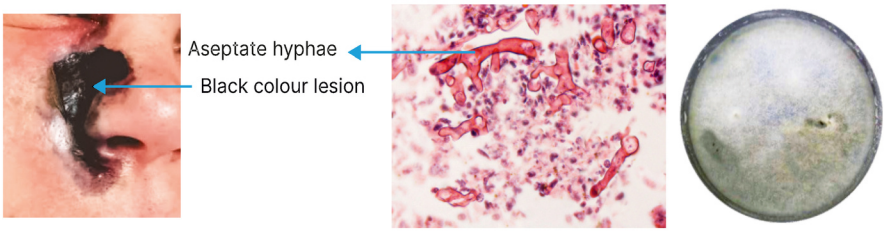
- By mutation of p53 at codon - 249
- Aflatoxin is a peanut or groundnut contamination

Q6.11: Write a short note on Mucormycosis.

Answer:

- Black fungus
- Aseptate
- Right-angled branching
- Mucor is broader, like a ribbon
- Lid - Lifters (SDA)
- Treatment:
  - Surgical resection
  - Amphotericin B

PYQ: NEET PG 2018,2022



Q6.12: Name the organisms that test negative for beta-D-glucan.

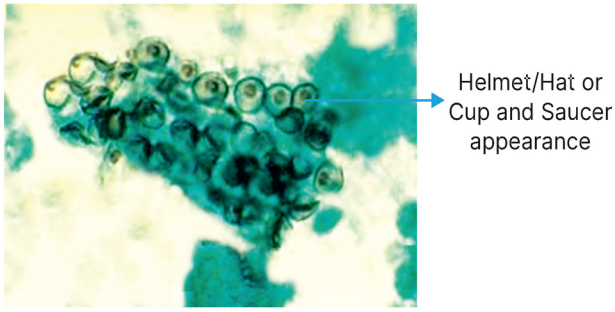
Answer:

- Mnemonic: **B**angalore **M**edical **C**ollege
  - **B**lastomyces
  - **M**ucorales
    - → Also Negative in Aspergillus galactomannan
  - **C**ryptococcus

Q6.13: Write a short note on Pneumocystis carinii.

Answer:

- Also known as Pneumocystis jiroveci
- Infection in HIV + : CD4 < 200
- Pneumocystis carinii pneumonia - plasma cell pneumonia (Dry cough, BAL)
- Black fungus - GMS stain is used
- Ping-pong crushed ball appearance
- These balls are cysts - trophozoite
- Treatment:
  - Cotrimoxazole
  - Severe cases - pentamidine



Q6.14: Tabulate the drug of choice for various fungal organisms.

Answer:

Organism	Treatment
Tinea Versicolor	Topical/ Systemic Azole
Dermatophytes	Azole/ Terbinafine **T.Capitis** = Griseofulvin
Blastomycosis Histoplasmosis Paracoccidioidomycosis Sporothrix	Amphotericin B + Itraconazole
Coccididomycosis Candida Cryptococcus	Amphotericin B + Fluconazole
Cryptococcal Meningitis	LAMB + Flucytosine
Candida Oral Thrush Candida Vulvo Vagina	Topical Nystatin Clotrimazole
Fundal Keratitis	Natamycin
Aspergillus	**V**oriconazole
Mucor	Amphotericin B + Posaconazole/Isavuconazole
Pneumocystis	Cotrimoxazole Pentamidine

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7. PARASITOLOGY PART-1

BIG QUESTION 1: What are the features of Entamoeba histolytica, their life cycle, clinical features, and management?

Broad Answer: Entamoeba includes tissue-invasive protozoans like E. histolytica and non-pathogenic ones like E. coli. They differ in morphology, pathogenicity, and diagnostic features. E. histolytica is known for causing flask-shaped ulcers and anchovy sauce liver abscesses, while E. coli is a non-invasive commensal. Stool examination, culture media, microscopy, and characteristic cyst morphology aid in diagnosis.

DETAILED QUESTIONS

Q1.1: Which family does Entamoeba histolytica belong to?

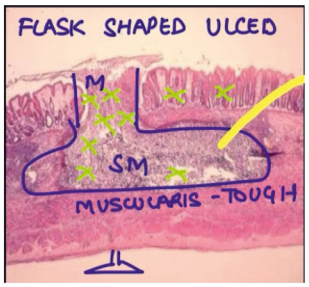
Answer:

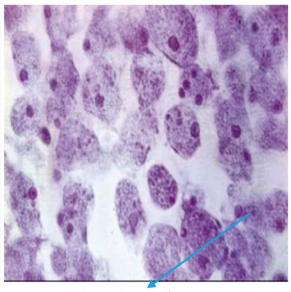
Family Amoebidae.

Q1.2: What are the key pathological features of Entamoeba histolytica?

Answer:

- Entamoeba histolytica breaks the tissue
- Flask-shaped ulcers: Trophozoites are seen inside it
- Red colored dots = RBCs → Erythrophagocytosis
- Liver abscess: Anchovy sauce appearance due to pus formation





Trophozoites



Anchovy sauce appearance

Q1.3: How is Intestinal Amoebiasis diagnosed?

Answer:

Diagnosis	Stool samples: **3 consecutive days** samples
Stool culture	Polyxenic medium • **Added supplements: For bacterial growth** • Craige's culture/nelson medium / balamuth medium / boeck and Dr bohlav medium
	Axenic culture medium • Pure culture media - not added any supplement • **Diamond medium**

Q1.4: Elaborate the differences between the trophozoite and cyst form of Entamoeba histolytica and Entamoeba coli.

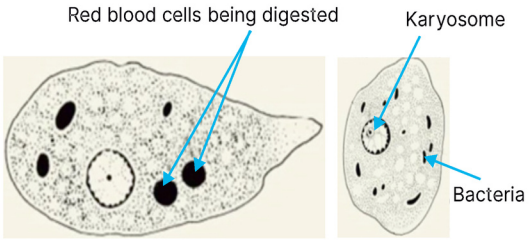
PYQ: FMGE 2019, 2022

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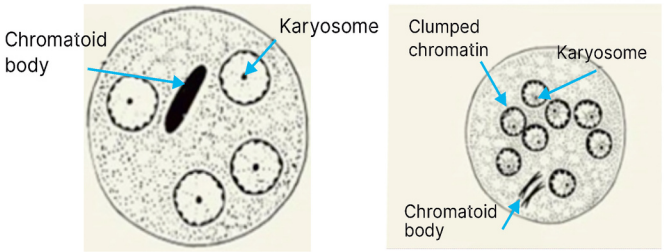
YOURWISH

Answer:

Entamoeba histolytica	Entamoeba coli
Trophozoite • RBCs are being engulfed i.e **Erythrophagocytosis** • It has one nucleus - **a central karyosomes**	Trophozoite • No erythrophagocytosis is seen • Show **eccentric karyosomes** • No RBCs
Cyst form • **Chromatoid body - made up of ribonucleoprotein** • 1-4 nuclei • **Cartwheel nucleus.**	Cyst form • **1-8 nuclei** • No cartwheel nucleus' • Chromatoid body -Composed of RNP



Trophozoites of Entamoeba histolytica (left) & Entamoeba coli (right)



Cysts of Entamoeba histolytica (left) & Entamoeba coli (right)

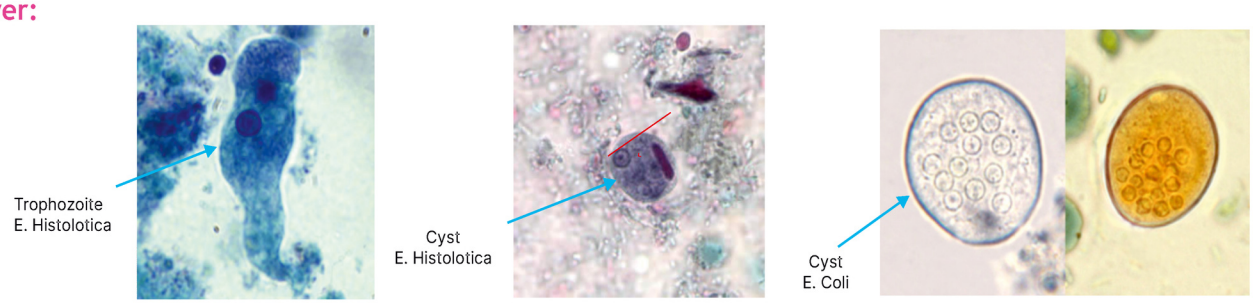
Q1.5: What is the stain used for the chromatoid body?

Answer:

Stain for Chromatoid body is Iron Hematoxylin Stain

Q1.6: How are the trophozoite and cyst forms of Entamoeba histolytica and Entamoeba coli identified with wet mount preparations?

Answer:



Trophozoite of Entamoeba histolytica showing ingested red cells (left), Cysts of Entamoeba histolytica (middle) & Entamoeba coli (right)

Q1.7: What are the characteristics of liver amoebiasis?

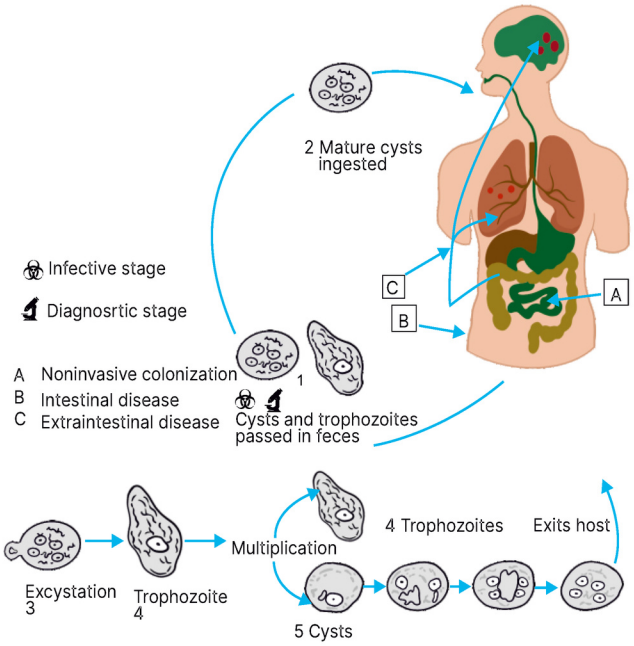
Answer:

- Liver abscess has anchovy sauce pus appearance
- Sample of anchovy sauce: Contains trophozoites

Q1.8: Describe the life cycle of Entamoeba histolytica.

Answer:

- Human host
- Mature form: Quadrinucleate cyst
- Route: Ingestion (Faeco-oral route)



Q1.9: What are the organisms with a small infectivity dose?

Answer:

Organisms with Small Infectivity Dose (Mnemonic: **CHHota SMALL**)

- **C** - Cryptosporidium
- **H** - E.Histolytica
- **H** - Enterohemorrhagic E.coli
- **S** - Shigella
- **LLAM** - Giardia lamblia

Q1.10: How is amoebiasis treated?

Answer:

Active infection

- Metronidazole × 10 days
- Followed by luminal amoebicide - Paromomycin

BIG QUESTION 2: What are the members of the free-living amoeba and what are their features?

Broad Answer: Free-living amoebas are opportunistic protozoans found in the environment. They cause rare but severe diseases like primary amoebic meningoencephalitis. Naegleria fowleri causes acute infections, whereas Acanthamoeba and Balamuthia are associated with chronic illnesses and corneal ulcers. Diagnosis includes CSF studies, biopsy, culture, and NAAT. Treatment differs for each organism.

DETAILED QUESTIONS

Q2.1: How do Naegleria fowleri and Acanthamoeba differ?

Answer:

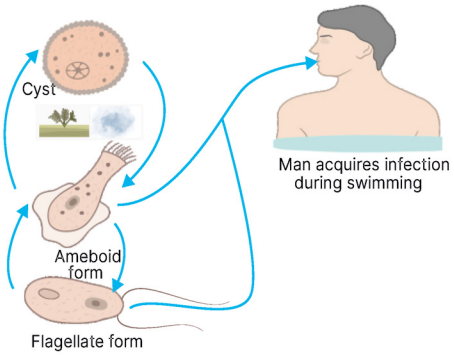
Naegleria fowleri	Features	Acanthamoeba (also associated with corneal ulcer)
Primary amoebic meningoencephalitis (PAME)	**Disease**	**Granulomatous amoebic encephalitis (GAME)**

Swimming	**Risk factor**	Immunodeficiency
Trophozoite	**Infective form**	Both Cyst and Trophozoite
Acute (fatal <5 days)	**Clinical course**	Chronic (late)
Neural	**Spread**	Blood
CSF study • Trophozoites • Increased polymorphs	**Diagnosis**	Brain biopsy • Trophozoites • Cysts
NNA (Non-Nutrient Agar) with lawn culture of E.coli	**Culture**	NNA (Non-Nutrient Agar) with lawn culture of E. coli
NAAT (Nucleic Acid Amplification Testing)	**Gold standard**	NAAT (Nucleic Acid Amplification Testing)
Amphotericin B	**Treatment**	**Pentamidine + Azole + Sulphonamide + Flucytosine**

Q2.2: What is the life cycle of Naegleria fowleri?

Answer:

- History of swimming
- Infective form: Trophozoite



Q2.3: How does Naegleria infection occur?

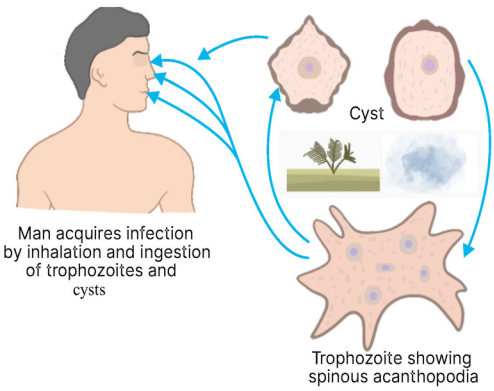
Answer:

Entry via swimming
↓
Water with Trophozoites enters the nose
↓
Reaches the brain (via cribriform plate)
↓
PAME (Primary Amebic Meningoencephalitis)

Q2.4: What is the life cycle of Acanthamoeba culbertsoni?

Answer:

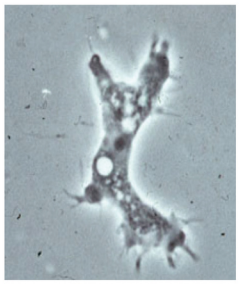
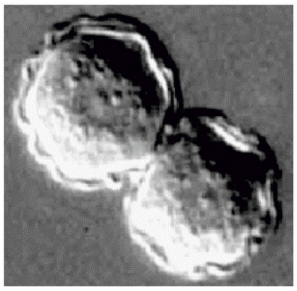
- Trophozoites show spikes (Acantho - Spikes)
- Cyst is present - Double Walled Cyst
- Both cysts and Trophozoites can cause disease (usually mmunodeficient patient)



YOURWISH

Q2.5: What are the key identifying features of trophozoites and cysts of Acanthamoeba?

Answer:

Trophozoite	Cyst
Shows spikes (Acantho- Spikes) 	Double-Walled Cyst (Outer Wrinkled Wall) 

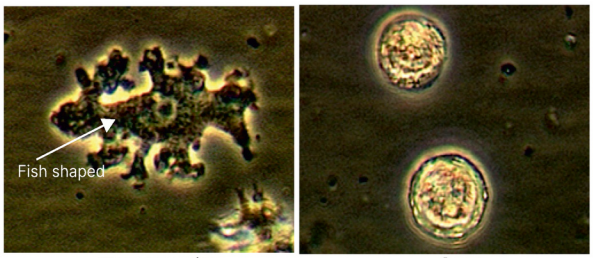
Q2.6: What are the unique clinical features associated with Acanthamoeba?

Answer:

Acanthamoeba can infect the eyes via contact lenses and lead to Amoebic Keratitis

Q2.7: What are the characteristics of Balamuthia mandrillaris, and how does it differ from Acanthamoeba?

Answer:



Trophozoite Cyst

Similarities with Acanthamoeba

- Disease: GAE (Granulomatous amoebic encephalitis)
- Causative: Trophozoite and Cyst

Difference from Acanthamoeba

- Trophozoite has a fish-like appearance
- Cyst is smoother
- It can occur in both immunocompetent and immunodeficiency individuals
- Does not infect the eyes

BIG QUESTION 3: What are the morphological features, clinical features, and treatment of Balantidium coli?

Broad Answer: Balantidium coli is a large ciliated protozoan that primarily infects the colon and can cause intestinal symptoms. It is typically associated with zoonotic transmission and presents variably, often resembling amoebic dysentery. Diagnosis is based on microscopic identification, and treatment is specific.

DETAILED QUESTIONS

Q3.1: Which is the only ciliated parasite that infects humans?

Answer: Balantidium Coli

Q3.2: What are the special features of Balantidium coli?

Answer:

- B - Big (Largest) Protozoa invading the human intestine
- B - Big (Large) intestine involvement
- Both trophozoite and cyst are Binucleated

YOURWISH

Q3.3: What is the infective form of Balantidium coli?

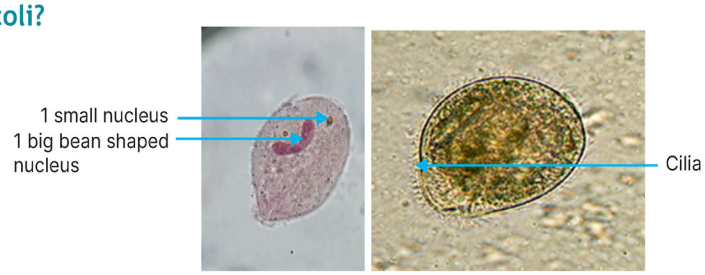
Answer: Cysts are the infective form of Balantidium coli.

Q3.4: What are the microscopic features of Balantidium coli?

Answer:

Binucleated:

- Big (macro) nucleus - Bean-shaped
- Small (micro) Dot - cilia
- Cilia - Can show active motility



Q3.5: What are the animal reservoirs of Balantidium coli?

Answer: Pigs

Q3.6: What are the diseases caused by Balantidium coli?

Answer:

- Asymptomatic in 50-80%
- Ciliate dysentery (invasive diarrhea)

Q3.7: What is the treatment of choice for Balantidium infection?

Answer: Doxycycline

Q3.8: List common intestinal protozoa along with the number of nuclei present in their trophozoite and cyst stages.

Answer:

Organism	Nuclei in	Nuclei in Cyst
• E. histolytica	1	4
• Entamoeba Coli cyst	1	8
• Balantidium Coli	2	2
• Giardia Lamblia	2	4
• Trichomonas Vaginalis	1	-

BIG QUESTION 4: What are the morphological features, symptoms, and management of Giardia lamblia?

Broad Answer: Flagellates are protozoan parasites that use flagella for movement. Among them, Giardia lamblia is the most common intestinal parasite worldwide. It causes malabsorption by affecting the duodenum and has characteristic trophozoite and cyst forms. Diagnosis is by stool microscopy, and treatment involves Metronidazole or Tinidazole.

DETAILED QUESTIONS

Q4.1: Which family does Giardia lamblia belong to?

Answer:

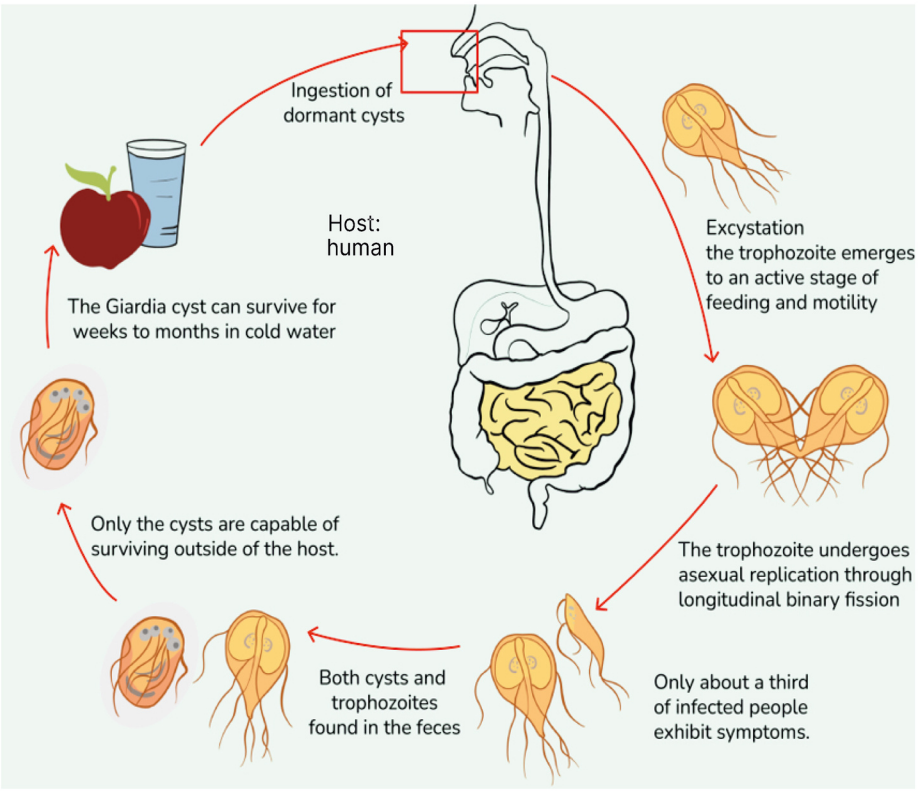
- Giardia belongs to the flagellate group of organisms
- Also known as the grand old angry man of the intestine (as they are commonly found in the duodenum)

Q4.2: What is the life cycle of Giardia?

PYQ: FMGE 2023

Answer:

- The most common parasitic infection in the world
- A common parasite found in stool
- Has a small infectivity dose



Life cycle of Giardia lamblia

Q4.3: What are the clinical features of Giardiasis?

Answer:

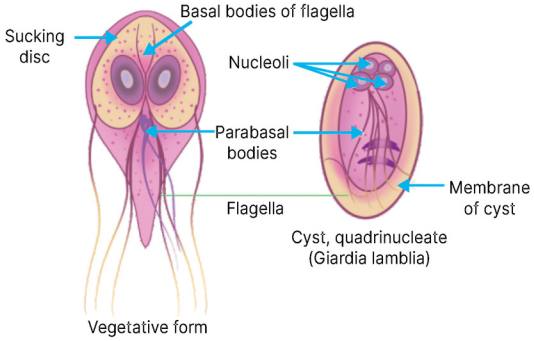
- The patient will get classical malabsorption because the Duodenum is affected
- Fat (Steatorrhea, bulky, frothy, foul-smelling stool), vitamin B12, folic acid, and protein deficiency.

Q4.4: How is Giardiasis diagnosed?

Answer:

Lab diagnosis

- Sample - 3-day consecutive Stool Sample
- Microscopy
  - o Cyst and trophozoite are seen
- Grand old angry man of the intestine
  - o Trophozoite with two nuclei
  - o Four pairs of flagella on the trophozoite (4×2 = 8 total)
  - o Angry
    - → Pear shape
    - → Tennis racket shape
  - o Cyst has 1-4 nuclei



Trophozoite of Giardia lamblia and cyst

Q4.5: What is a string test?

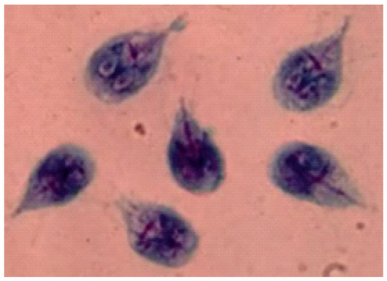
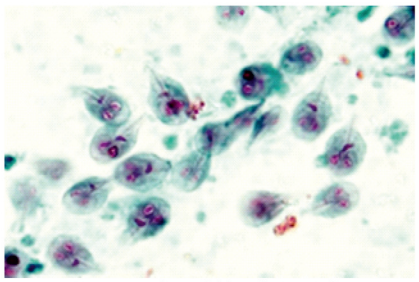
PYQ: NEET PG 2020

Answer:

- Also known as Entero-test
- The string is put into the intestine (duodenum)
- A microscopic examination is then done

Q4.6: What is the microscopic appearance of Giardia (Trophozoites and cysts)?

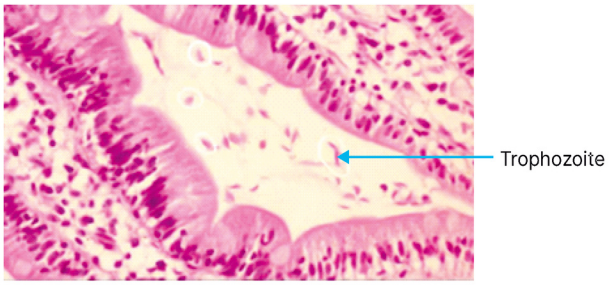
Answer:

Trophozoite of Giardia lamblia- 2 nuclei and flagella seen	Cyst of Giardia lamblia- 4 nuclei are seen
 Microscopy: Trophozoite of Giardia lamblia  Trophozoite of Giardia lamblia	

Q4.7: What is the histopathological appearance of Giardia?

Answer:

- Duodenal biopsy shows:
  - Organisms hanging in the lumen
  - Sickle-shaped organisms are seen in the lumen
  - Falling leaf motility is seen



Q4.8: How is Giardiasis treated?

Answer:

- Drug of choice: Metronidazole
- Tinidazole can also be given
  - Single dose of 2g

BIG QUESTION 5: What are the features, clinical manifestations and management of Trichomnas vaginalis?

Broad Answer: Trichomonas vaginalis is a flagellated protozoan that causes sexually transmitted infections. It exists only on the trophozoite form and does not form cysts. It commonly presents with frothy vaginal discharge. Diagnosis is via wet mount microscopy, and metronidazole is the treatment of choice.

DETAILED QUESTIONS

Q5.1: Infection with trichomonas vaginalis typically presents with which clinical syndrome?

Answer: Trichomonas vaginalis is the most common cause of STD and NGU (non-gonococcal urethritis)

Q5.2: What is the mode of infection of trichomoniasis?

PYQ: FMGE 2022 PYQ: NEET PG 2023

Answer:

Habitat	Vagina, urethra, prostrate
Mode of transmission	Sexual contact
Reservoir	Females
Infective stage	Trophozoite only
Diagnostic stage	No cyst formed

Q5.3: What are the symptoms of trichomoniasis?



Answer:

- In male
  - Urethritis
  - Bladder involvement (cystitis)
  - Prostate involvement (Prostatitis)
- In Female
  - Strawberry cervix (A greenish discharge is seen)

Q5.4: What type of motility is exhibited by Trichomonas?

Answer: Trichomonas shows twitching motility / Jerky motility

Q5.5: What are the culture media used to grow trichomonas?

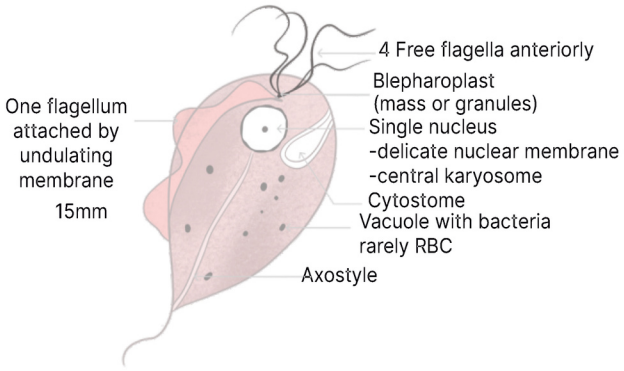
Answer:

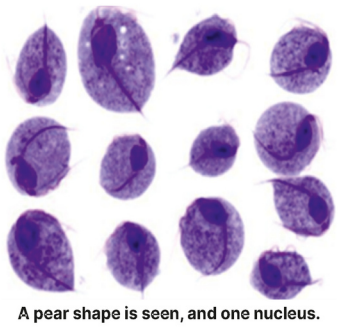
- Lash cysteine hydrolysate serum
- Diamond medium

Q5.6: What are the microscopic characteristics of Trichomonas?

Answer:

- Sample - discharge sample from PAP smear (Mnemonic: fashionable aunty who loves diamonds and strawberries Cilia)
- Only trophozoites are seen on microscopy
- Only one nucleus, four anterior flagella, and one posterior flagellum with an undulating membrane





A pear shape is seen, and one nucleus.

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Q5.7: What is the treatment of choice for trichomoniasis?

Answer:

- DOC is metronidazole
- The partner needs to be treated as well.

BIG QUESTION 6: What are hemoflagellates? What are the features of Trypanosoma cruzi?

Broad Answer: Hemoflagellates are a group of protozoa that live in blood and tissue fluids and are transmitted by insect vectors. They include Leishmania and Trypanosoma. Trypanosome cruzi is responsible for causing American trypanosomiasis or Chagas disease.

DETAILED QUESTIONS

Q6.1: What are the main members of Hemoflagellates?

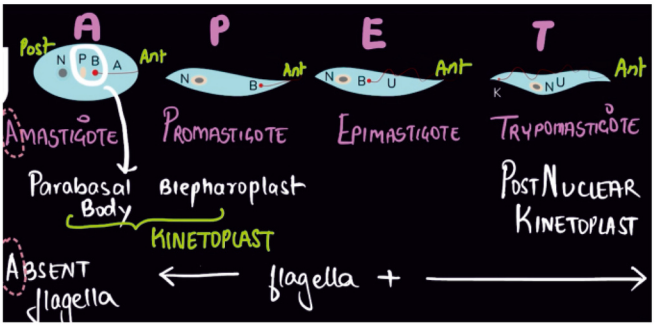
Answer:

- Leishmania
- Trypanosoma

Q6.2: What are the morphological forms of hemoflagellates?

Answer:

Mnemonic: **APET**



- **A** - Amastigote
  - Absent flagella
- **P** - Promastigote
- **E**- Epimastigote
- **T** - Trypomastigote
  - Only variant to have a Post-nuclear kinetoplast
- In all other cases, the kinetoplast is in front of the nucleus

Q6.3: What are the morphological forms seen in Trypanosoma cruzi?

Answer:

Mnemonic: CATE

PYQ: FMGE 2019

- **C** - Trypanosoma Cruzi
- **A** - Amastigote;
- **T** - Trypomastigote;
- **E** - Epimastigote: Only seen in insects

Q6.4: What is the vector of Trypanosoma cruzi, and what disease does it cause?

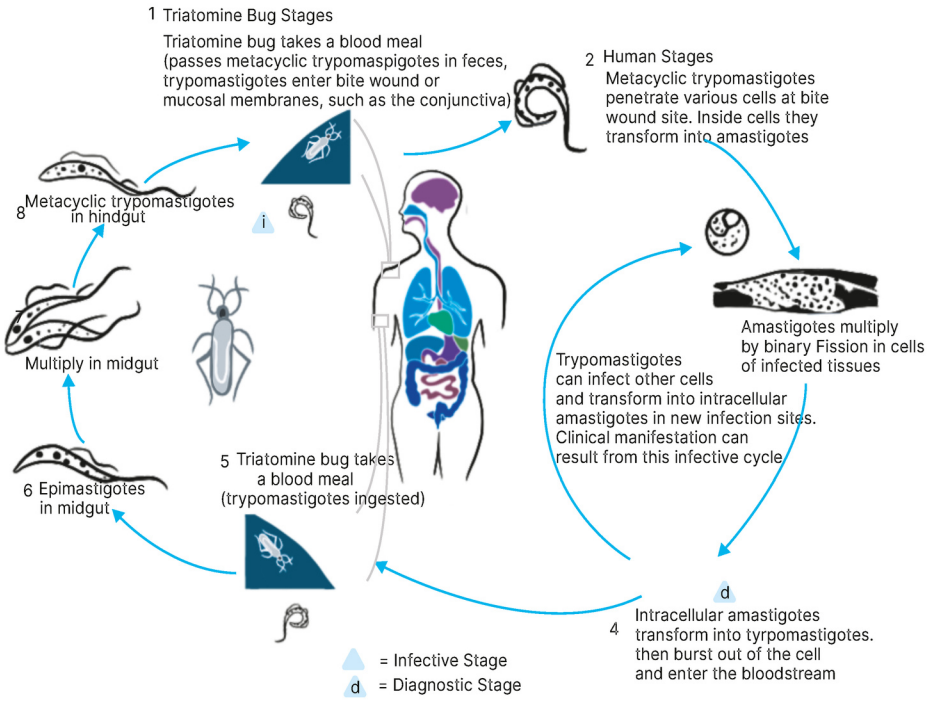
Answer:

- Vector: Reduviid bug/ triatomine bug
- Disease: Chagas disease/South American sleeping sickness

Q6.5: What is the life cycle of Trypanosoma cruzi?

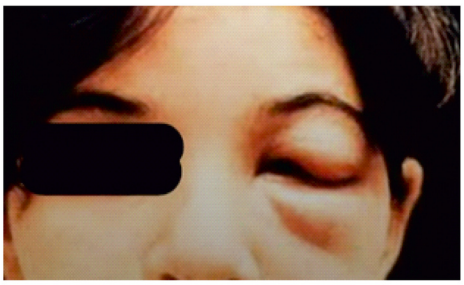
Answer:

- In insects, the Epimastigote is seen & in Adults, the trypomastigote is seen.
- In humans, **TAT**, i.e., Trypomastigote, Amastigote, and Trypomastigote
- In insects, **TET**, i.e., Trypomastigote, Epimastigote, Trypomastigote



Q6.6: What are the features of Chagas disease?

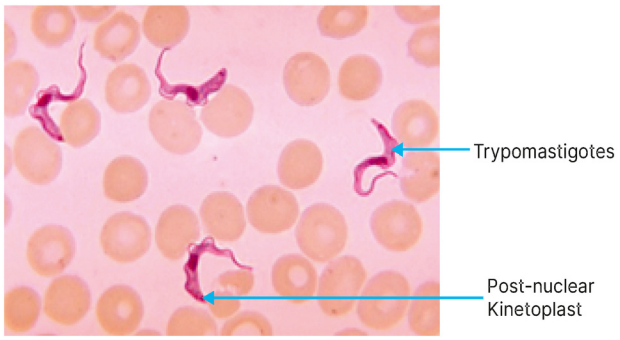
Answer:

Acute Chagas Disease	Features	Chronic Chagas Disease
• Chagoma (entry site edema) • Everything big (LAP, HSM)	**Sites**	• Heart: Myocarditis • GIT: **Megaoesophagus, megacolon**
Romana Sign: Periorbital Oedema 		Brain (Meningoencephalopathy)

Q6.7: What is the lab diagnosis of Chagas disease?

PYQ: AIIMS 2018

Answer:



- Sample: **Blood sample / Buffy Coat (WBCs part between RBCs & Plasma)**
- Culture: **NNN media**

- Microscopy:
  - Trypomastigote form
  - There is a Nucleus in the centre & Kinetoplast from where the Flagella are going and coming out from the anterior end, known as **Post-nuclear Kinetoplast**

Q6.8: What is the drug of choice for Chagas disease?

Answer:

Benznidazole.

Q6.9: What are the parasites that cause Myocarditis?

Answer:

Mnemonic: MyocardiTEs

- **T** - Trichinella Spiralis
- **T** - Trypanosoma Cruzi
- **T** - TB Rhodesiense
- **T** - Toxoplasma gondii
- **E** - Echinococcus

BIG QUESTION 7: What are the morphological features, life cycle, diseases, and management of Trypanosoma brucei ?

Broad Answer: Trypanosoma brucei is a hemoflagellate protozoan parasite that causes African sleeping sickness, transmitted by the tsetse fly. The disease typically progresses through hemolymphatic and neurological stages. It presents with intermittent fever, lymphadenopathy, and CNS disturbances like altered sleep patterns. Diagnosis involves parasite detection in blood or CSF. Treatment depends on the stage and species involved.

DETAILED QUESTIONS

Q7.1: What are the morphological forms seen in Trypanosoma brucei?

Answer:

Mnemonic: **BET**

- **B** - Trypanosoma Brucei
- **E** - Epimastigote
- **T**- Trypomastigote are seen

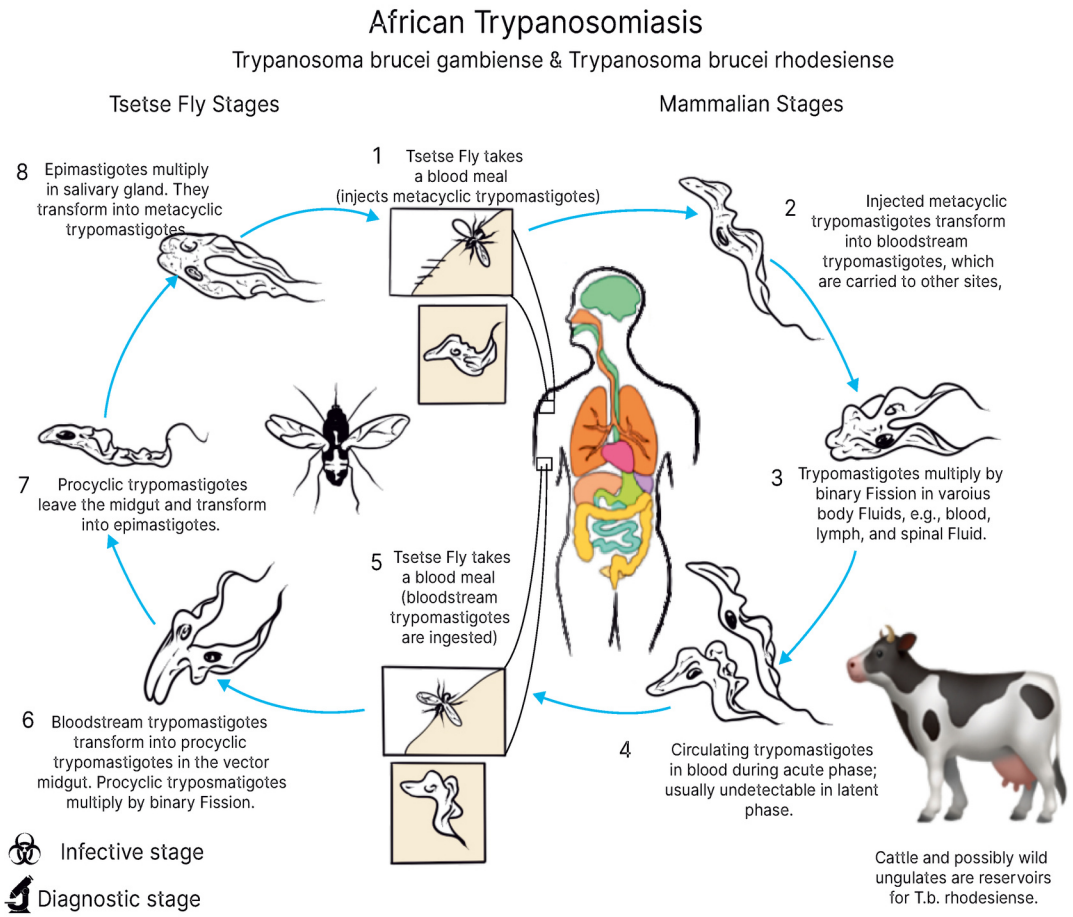
Q7.2: What is the vector of Trypanosoma brucei, and what disease does it cause?

Answer:

- Vector: Tsetse fly
- Disease: Sleeping sickness- West African/ East African sleeping sickness

Q7.3: What is the life cycle of Trypanosoma brucei?

Answer:



Q7.4: What are the types of diseases caused by Trypanosoma brucei?

Answer:

- West African sleeping sickness
- East African sleeping sickness

Q7.5: What are the clinical features and management of Trypansoma brucei infections?

Answer:

T.B Gambiense (sleeping sickness)	Feature	T.B Rhodesiense
West African sleeping sickness	**Aka**	**East African sleeping sickness**
TseTse fly	**Vector**	TseTse fly
Humans	**Primary reservoir**	Animals
Winterbottom sign (LAP)- Patient with Post. Cervical LN	**C/f**	-
Less	**Parasitemia Virulence Resistance**	More
Early Cases: Pentamidine Late Cases: Eflornithine/Nifurtimox	**Treatment**	Early Cases: Suramine Late cases: Melarsoprol

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YOURWISH

BIG QUESTION 8: What are the morphological features, life cycle, diseases, and management of Leishmania?

Broad Answer: Leishmania is an intracellular protozoan parasite transmitted by sandflies, affecting the reticuloendothelial system. It causes a spectrum of diseases, including visceral, cutaneous, and mucocutaneous leishmaniasis. Clinical features vary from skin ulcers to hepatosplenomegaly and pancytopenia. Diagnosis involves demonstration of amastigotes or serological tests. Management includes antimonial compounds or amphotericin, depending on the type.

DETAILED QUESTIONS

Q8.1: What are the morphological forms seen in Leishmania?

Answer:

Mnemonic: LAP

- **L** - Leishmania
- **A** - Amastigote
- **P** - Promastigotes are seen

Q8.2: What is the vector of Leishmania, and what disease does it cause?

PYQ: NEET PG 2018,2021

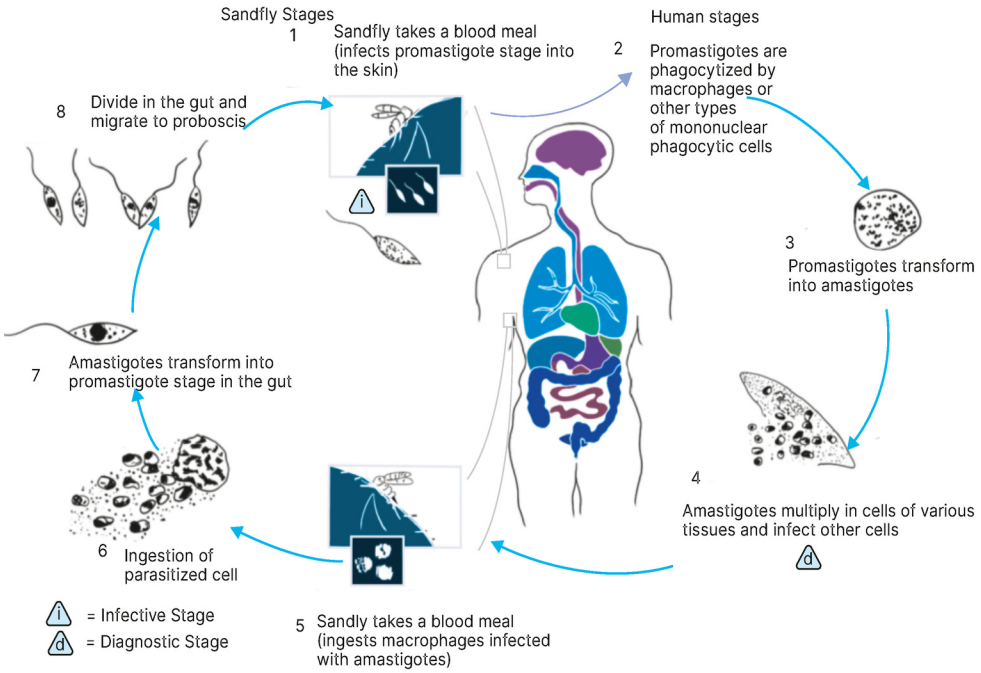
PYQ: AIIMS 2020

Answer:

- Vector: Sandfly
- Disease: Kala-azar

Q8.3: What is the life cycle of Leishmania?

Answer:



Q8.4: What is the infective form and diagnostic form of Leishmania?

Answer:

- Infective Form: Promastigote
- Diagnostic Form: Amastigote
  - L.D. bodies seen by microbiologists are Amastigote

Q8.5: What are the clinical features of Kala-azar?

Answer:


Protuberant abdomen

- Prolonged fever
- Progressive weight loss
- Hepatosplenomegaly
- **Note:** named Kala azar due to blackish pigmentation of the skin

Q8.6: How is kala-azar diagnosed?

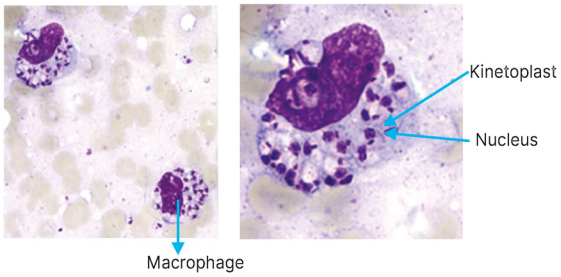
Answer:

Sample taken:

- Spleen (most sensitive)
  - The spleen is a big and extremely vascular organ & can result in bleeding
- BM (most preferred) and Blood
- BAL (HIV)
  - It is because in HIV+ patients spleen and liver are not very commonly involved, so the lung might be involved

Hypergammaglobulinemia tests

- Napier's aldehyde test
- Chopra's antimony test
- Media: NNN (also used in T. cruzi)
- Microscopy: Promastigotes are seen
- RK39 antigen (rapid card test)
- PCR- definitive test



Q8.7: What is the drug of choice for Kala-azar?

Answer:

Drug of choice: Liposomal Amphotericin B.

Q8.8: What are the features and management of post-kala-azar dermal leishmaniasis?

Answer:



- 1-2 years after treatment of Leishmaniasis with Liposomal Amphotericin
- The affected person develops Hypopigmented nodules known as Post Kala Azar Dermal Leishmaniasis (PKDL).
- Treatment: Oral Miltefosine

Q8.9: What are the other variants of Leishmania?

Answer:

- L. Tropica: Oriental Sore / Delhi Boil/Aleppo button
- L. Brasiliensis: Mucocutaneous Leishmaniasis / Espundi

Q8.10: What are the features of Leishmaniasis recidivans?

Answer:



PYQ: NEET PG 2023

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

BIG QUESTION 9: What are coccidian parasites? Explain in detail the transmission, diseases, and management of Toxoplasma infection.

Broad Answer: Coccidian parasites are a group of intracellular protozoa that primarily affect the intestinal or systemic tissues, often transmitted through fecal-oral or zoonotic routes. Among them, Toxoplasma gondii is notable for causing both congenital and acquired infections. It spreads through contaminated food, water, or transplacental routes and can lead to systemic manifestations. Diagnosis and treatment vary based on immune status and clinical severity.

DETAILED QUESTIONS

Q9.1: What are the members of coccidian parasites?

Answer:

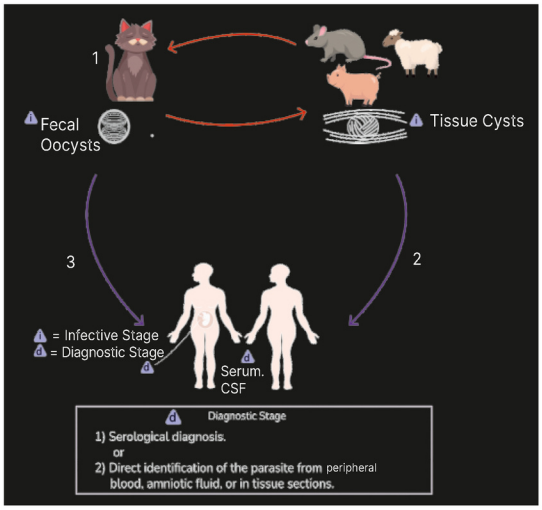
- Toxoplasma gondii
- Cryptosporidium
- Cyclospora
- Isospora
- Sarcocystis

Q9.2: What is the life cycle of Toxoplasma gondii?

PYQ: AIIMS 2021,2023

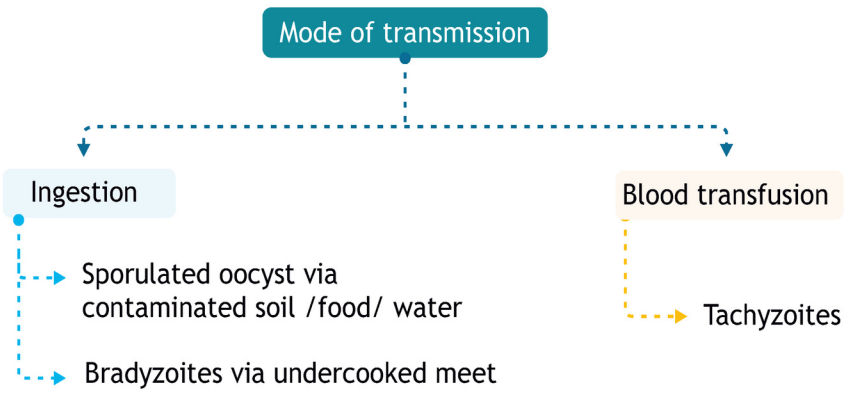
Answer:

- Definitive host: Cat
- Intermediate host: Human
- Different forms: Sporulated oocyst, bradyzoite, and tachyzoite



Q9.3: What are the modes of transmission of toxoplasmosis?

Answer:



YOURWISH

Q9.4: What are the variants of toxoplasmosis?

Answer:

Variants of toxoplasmosis		
Congenital Toxoplasmosis	**Adult toxoplasmosis**	**HIV+ toxoplasmosis**
• More severe in trimester I • More common in trimester III o Chorioretinitis o Intracerebral calcification o Convulsions o Microcephaly o Mental retardation	• Asymptomatic o LN enlarged	• Encephalitis • Most commonly brainstem is affected

Q9.5: What are the types of calcifications seen in various infections?

Answer:

- Toxoplasma shows intracerebral calcification
- CMV shows periventricular calcification

Q9.6: What is Sabin-Feldman test, and its interpretation?

Answer:

- Sabin Feldman test: Gold standard
  - o Test uses Methylene blue
    - → If colorless: antibodies are present
    - → If color is present: antibodies are absent

Antibodies	Interpretation
IgM +ve, IgG -ve	Acute infection
IgM +ve, IgG +ve (low avidity)	Acute infection
IgG +ve (Strong avidity)	Chronic infection

Q9.7: What is the treatment of Toxoplasmosis?

Answer: Treatment: Pyrimethamine + Sulfadiazine

BIG QUESTION 10: What are the causes of diarrhea in immunocompromised hosts, and what are their differentiating features, presentation, and management?

Broad Answer: In immunocompromised individuals, parasitic infections such as Cryptosporidium, Cyclospora, and Isospora are important causes of persistent or chronic diarrhea. These coccidian parasites differ in morphology, staining, and clinical features. Diarrhea may be profuse and watery, especially in AIDS patients. Diagnosis is based on modified acid-fast staining, and management involves specific antimicrobial therapy along with supportive care.

DETAILED QUESTIONS

Q10.1: What are the causes of diarrhea in an immunocompromised host?

Answer:

- Cryptosporidium

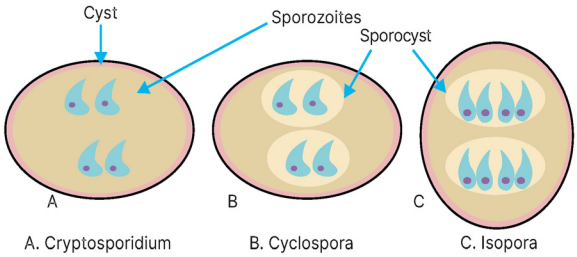
YOURWISH

- Cyclospora
- Isospora

Q10.2: How do Cryptosporidium, Cyclispora, and Isospora differ in sporozoite number and arrangement?

Answer:

PYQ: AIIMS 2020



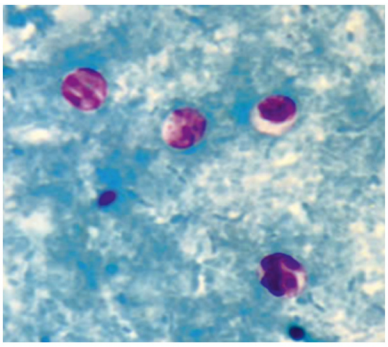
- Cryptosporidium: 4 sporozoites
- Cyclospora: 4 sporozoites (split into a pair of 2)
- Isospora: 8 sporozoites (split in pairs of 4)

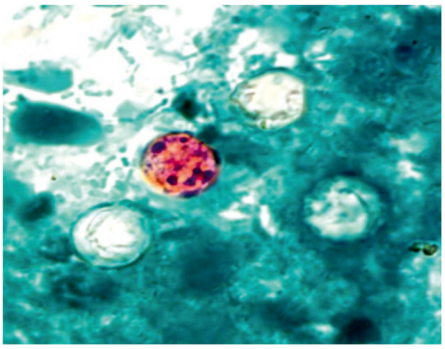
Q10.3: What are the differentiating features of Cryptosporidium, Cyclospora, and Isospora?

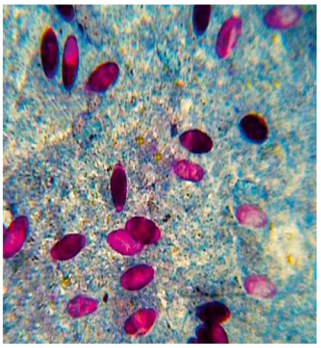
PYQ: AIIMS 2022

Answer:

Feature	Cryptosporidium	Cyclospora	Isospora
Size	4 - 6microns	8 - 12microns	24 - 36microns
Shape	 Round	 Round	 Oval
Acid-fast	+	Variable (+/-)	+
Autofluorescence	-	+	
Treatment	Nitazoxanide	Cotrimoxazole	


Cryptosporidium


Cyclospora Variable acid Fast


Isospora

Q10.4: What is a notable food source linked to Cyclospora infection?

Answer: Raspberry consumption

Q10.5: What are the features of Cryptosporidium?

Answer:

- Causes autoinfection

- Attaches to the brush border of the intestine
- Parasite hides in a tunnel known as the parasitophorous vacuole



BIG QUESTION 11: What are the members of Hematozoa? Explain in detail the morphology, life cycle, clinical manifestations, and management of Plasmodium.

Broad Answer: Hematozoa are blood-dwelling protozoan parasites. It consists of Plasmodium and Babesia. Plasmodium is transmitted to humans by the bite of infected Anopheles mosquitoes and has a complex life cycle with forms like sporozoites and merozoites. Morphologically, it appears in different blood stages and gametocytes. Clinically, it causes fever, chills, anemia, and splenomegaly. Diagnosis is by peripheral smear or rapid tests, and treatment depends on the species and severity, supported by vector control measures.

DETAILED QUESTIONS

Q11.1: What are the members of Hematozoa?

Answer:

- Plasmodium
- Babasia

Q11.2: Differentiate Plasmodium species based on relapse and recrudescence.

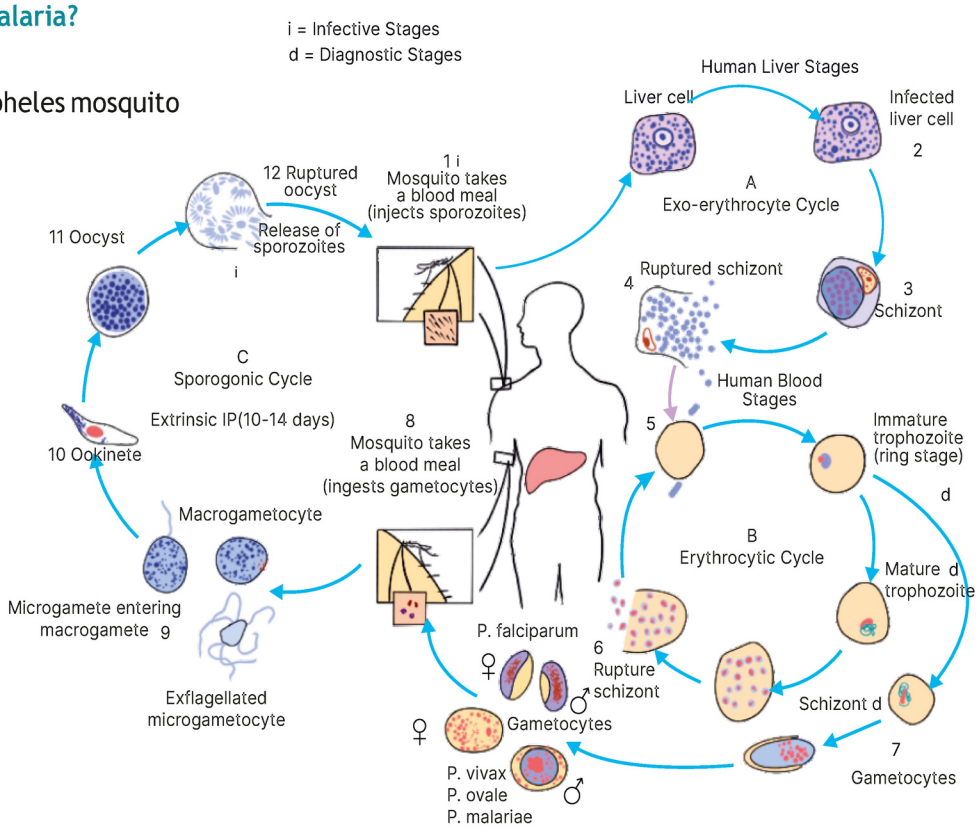
Answer:

Features	P. vivax	P. Falciparum	P. Malariae	P. Ovale
Relapse (re-activation of hypnozoites -Inactive in liver)	Yes			Yes
Recrudescence (inadequate treatment)		Yes	Yes	

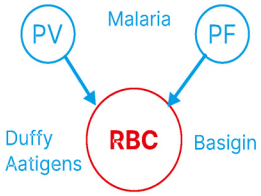
Q11.3: What is the life cycle of Malaria?

Answer:

- Definitive host: Female anopheles mosquito
- Intermediate: Man
- Infective form to MAN
  - o Sporozoites from saliva
  - o Trophozoites from blood and MTC



Q11.4: What are the immune responses against malaria?



PYQ: AIIMS 2022

Answer:

- Malaria needs Duffy antigens - only then malaria fever can occur.
- But few humans don't have Duffy antigens. Hence, they are Immune to malaria
- No relapse in malaria with blood transfusion.

Q11.5: Describe the stages of Plasmodium transmission between mosquitoes and humans.

Answer:

- Infection form to mosquito: Gametocytes
  - It takes at least 12 gametocyte/microlitre blood meal.
- Sporozoite from the saliva of mosquitoes to humans
- Trophozoites: from blood and MTC transmission

Q11.6: Which conditions are associated with natural immunity against malria?

Answer:

- SC traits
- Thal Trait
- Fetal Hb
- G6PD deficiency
- Ovalocytosis
- Absence of Duffy antigen

Q11.7: What are the features of benign malaria?

Answer:

- Benign malaria: Febrile paroxysms
  - Cold phase: Chills and shivering
  - Hot phase: Fever
  - Sweating

Q11.8: What are the features of malignant malaria?

Answer:

- Cerebral malaria
- Pathology: Durck Granuloma - P.falciparum

Q11.9: What is black water malaria?

Answer:

- RBC breakdown
- Intravascular hemolysis
- Hemoglobinuria

Q11.10: What are the renal manifestations of malaria?

Answer:

- Nephrotic syndrome (MGN)
- Most common with plasmodium malaria

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Q11.11: What is algid malaria?

Answer: Malaria with circulatory failure

Q11.12: Where is Plasmodium knowlesi found, and what is its primary reservoir host?

Answer:

- Found in Malaysia
- Caused by monkeys

Q11.13: What are the various lab tests available for the diagnosis of malaria?

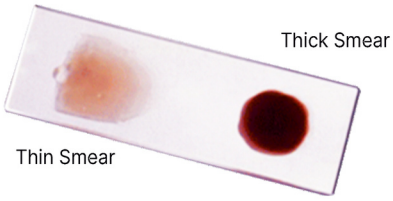
Answer:

- Light microscopy: Gold standard
- Fluorescent microscopy - rapid screening modalities - expensive
- Microhematocrit method
  - QBC: Quantitative buffy coat
- RDT- Rapid diagnostic test/card test
- PCR: Most sensitive test
- Kawamoto technique - acridine orange
- The screening method of choice: Peripheral blood smear examination.

Q11.14: What are the light microscopy methods used for the diagnosis of malaria?

Answer:

- Gold standard
- Thick smear: For the quantification of malaria
  - Thick smear: Sensitivity- 5 parasites /microlitre
- Thin smear (tongue-shaped smear) for species identification
  - Thin smear: Sensitivity - 200 parasites/ microlitre



Q11.15: What are the stains used for malaria microscopy?

Answer:

- Romanowsky stain
- JSB: Jaswant Singh & Bhattacharya Staining
- 200-300 OIF (oil emergent field- 100x) examined before reporting negative

Q11.16: What is the RBC involvement pattern of different Plasmodium species?

Answer:

- Vivax and ovale affect young RBCs, leading to enlargement
- All the other plasmodium will involve all the RBCs

Q11.17: What are the characteristic stippling patterns seen on light microscopy, and how do they help differentiate Plasmodium species?

Answer:

	Vivax	Falciparum	Malariae	Ovale
Medical examination	Schuffner dots	Maurer's cleft	Ziemann's dots	James dots

YOURWISH

Q11.18: How is malarial pigment formed?

Answer:

- Malarial pigment = Hemozoin
- It is formed when hemoglobin changes to hemozoin (yellow-brown pigment).
- It is a property of all Plasmodium species.

Q11.19: What forms of the malaria parasite are typically observed under a microscope?

Answer:

- Under light microscopy, the following stages of Plasmodium are seen in stained peripheral blood smear:
  - Trophozoites
  - Schizonts
  - Gametocytes

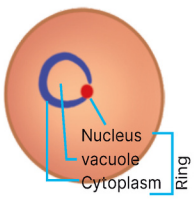
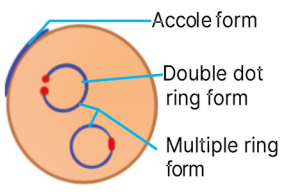
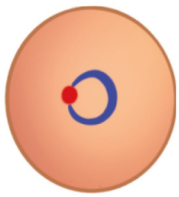
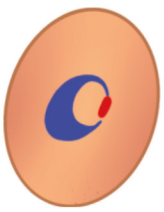
Q11.20: What are the morphological differences observed in various Plasmodium species under light microscopy?

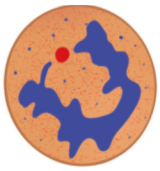
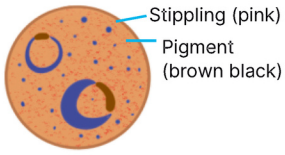
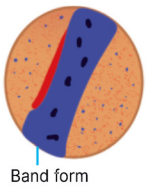
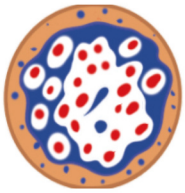
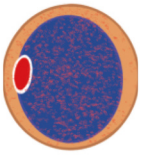
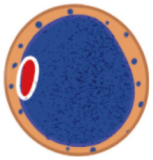
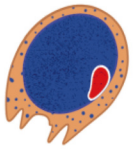
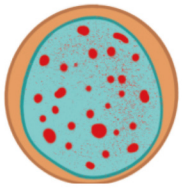
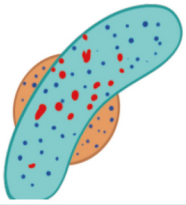
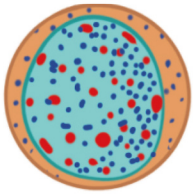
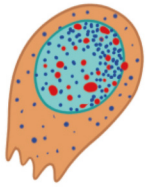
Answer: PYQ: FMGE 2020,2021 PYQ: NEET PG 2020 PYQ: AIIMS 2021

		P. Vivax	P. Falciparum	P. Malariae	P. Ovale
Trophozoites (ring form)	• Ring form (early trophozoites)	• One Ring • One Dot-Chromatin	• Multiple rings • Multiple dots	• Band form	• All similar to earlier plasmodium microscopic examination
	• Developing tropho-zoites	• Amoeboid Shape	• Accole/applique form • Margination of ring		
Schizonts	• Immature • Mature	• Merozoites	• Not seen in the blood sample		
Gametocytes	• Micro - males gameto-cytes	• Oval Gameto-cytes • Central Chromatin	• Banana-shaped gametocyte for micro(males) • Broad ends • Chromatin spread out		
	• Macro - females • Gametocytes	• Oval Gametocytes • Eccentric Chromatin	• Banana shaped gametocyte for macro (females) • Pointed ends • Chromatin organized		

Q11.21: How do trophozoites, schizont, and gametocyte forms appear for different Plasmodium species?

Answer:

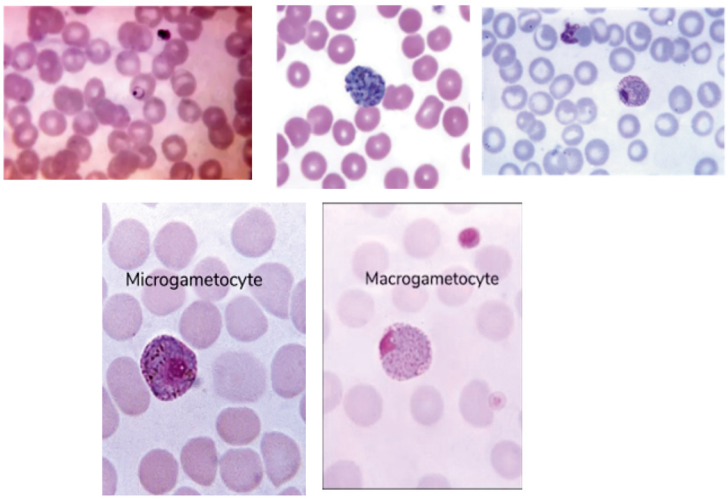
Plasmodium	P.vivax	P.falciparum	P. malariae	P. ovale
Early trophozoite				

Late trophozoite				
Schizont				
Female gametocyte				
Male gametocyte				

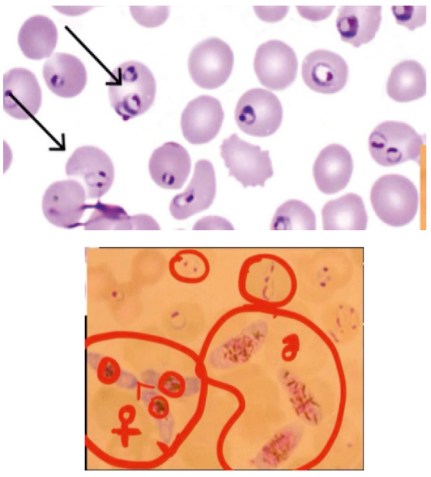
Q11.22: What do stained blood films look like in malaria caused by different species of Plasmodium?

Answer:

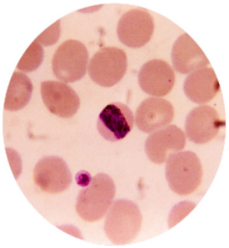
1. **P. Vivax**



2. **P. Falciparum**



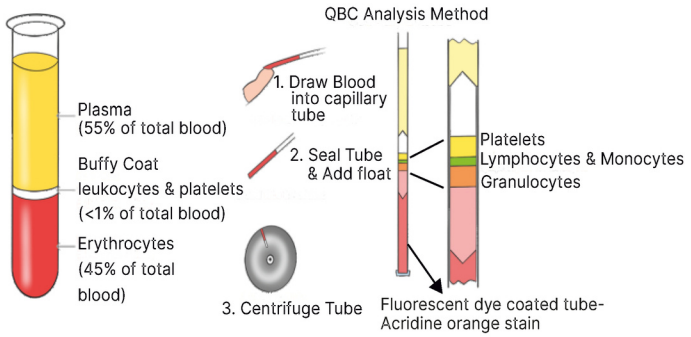
3. **P. Malariae**

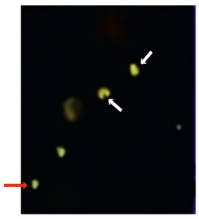


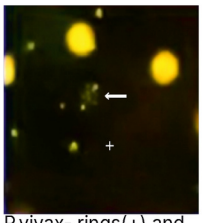
Q11.23: What is QBC (Quantitative buffy coat) analysis?

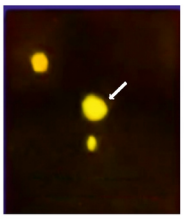
Answer:

- Buffy Coat- blood is taken and spinned
  - RBC at the bottom
  - Plasma at the top
  - Tiny little area in middle - called Buffy Coat
  - All the organisms stays at the buffy coat - malaria, filaria
  - Sensitivity is equal to 2 parasites/microlitre blood




P.vivax- trophozoites


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


P.vivax- gametocytes

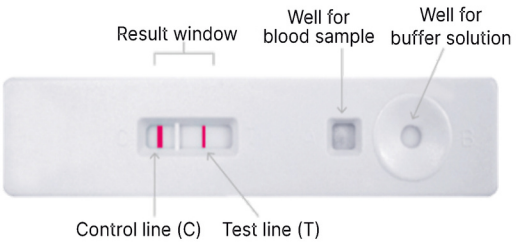
Q11.24: What are the features of rapid diagnostic test (RDT) and its interpretation?

PYQ: NEET PG 2023

Answer:

Rapid diagnostic test: card test

- Principle: Immunochromatography
- Sensitivity = 50-100 parasites/microlitre
- Nitrocellulose membrane
- Control line- validation line



Q11.25: What is the importance of HRP-2 aldolase, and LDH in malaria rapid testa?

Answer:

- All the malaria species have aldolase and LDH
- P.falciparum has histidine rich protein 2- HRP2
- Used to detect mixed infections or identify falciparum species specifically in RDT kits



BIG QUESTION 12: What are the features, clinical manifestations, diagnosis, and treatment of Babesia?

Broad Answer: Babesia is a protozoan parasite classified under Hematozoa, which infects red blood cells. It is transmitted mainly by Ixodes ticks and can also spread through blood transfusion. Clinically, it presents with malaria-like symptoms such as fever, hemolytic anemia, and fatigue, and is diagnosed by blood smear showing characteristic ring forms.

DETAILED QUESTIONS

YOURWISH

Q12.1: What are the hosts of Babesia?

Answer:

- Definitive hosts: Hard tick
- Intermediate hosts: Rodent/mammal
- Accidental dead-end hosts: Humans

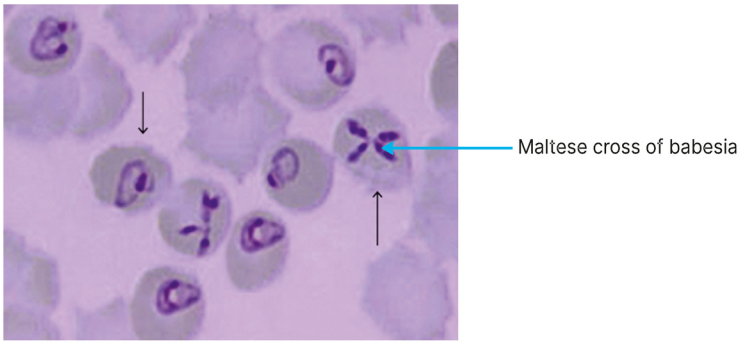
Q12.2: What are the clinical features of Babesiosis?

Answer: Fever, malaise, chills, sweating

Q12.3: What is the characteristic diagnostic finding seen in Babesiosis?

PYQ: FMGE 2019
PYQ: AIIMS 2019

Answer: Maltese Cross: Rings are making a tetrad of rings



Q12.4: How is Babesia infection treated?

Answer:

- Azithromycin + Atovaquone
- In severe cases · Clindamycin + Quinine

YOURWISH

8. PARASITOLOGY PART - 2

BIG QUESTION 1: What are cestodes, and what diseases can they cause?

Broad Answer:

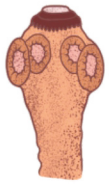
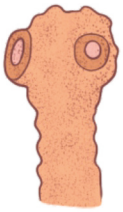
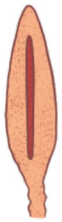
Cestodes, also known as tapeworms, are flat, segmented, ribbon-like helminths that inhabit the intestinal tract of their hosts. They lack a digestive system and absorb nutrients directly through their body surface. Common examples include Taenia solium, Taenia saginata, and Echinococcus, which can cause diseases like taeniasis, cysticercosis, and hydatid disease

DETAILED QUESTIONS

Q1.1: Tabulate how cestodes differ from each other in terms of their head characteristics.

PYQ: AIIMS 2020

Answer:

	T. solium	T. Saginata	H. Nana	H. Diminuta	D. Latum	Coccus
Head						
	4 suckers 2 rows of hooklets	4 suckers No hooks	4 suckers A single row of 20-30 hooklets	4 suckers No hooks	2 Suctorial grooves or bothria, **no suckers**, No hooks	4 suckers 2 rows of hooklets

Q1.2: Which cestode doesn't have a sucker on its head?

Answer:

- Diphyllobothrium latum (leaf-like configuration) does not have suckers but has 2 **suctorial grooves.** Rest all of them have suckers

Q1.3: Name the cestodes that don't have hooklets.

Answer:

- T. Saginata
- Diphyllobothrium latum
- H. diminuta

Q1.4: Name the cestode with a single host.

Answer:

- H. Nana, the smallest, also known as the Dwarf Tapeworm

Q1.5: Tabulate the difference between cestodes based on the definitive and intermediate host.

Answer:

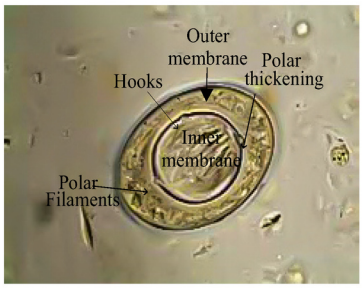
PYQ: NEET PG 2020 | PYQ: AIIMS 2018 | PYQ: FMGE 2019

Cestode	Definitive host	Intermediate host/s	Extra
H nana	• Man	_	• The most common cestode infection, single host: Dwarf tapeworm
H diminuta Rat tapeworm	• Man/Rat	• Beetles	• Rat Tapeworm
D. latum (3 hosts) Diphyllobothrium (DiFISHO)	• Man	• 1st IMH : Cyclops • 2nd IMH: Freshwater Fish	• Associated with B12 deficiency (megaloblastic Anemia) AKA fish tapeworm
Taenia solium	• Man	• Pig	• Intestinal involvement • Neurocysticercosis
Taenia saginata	• Man	• Cattle	• Intestinal involvement
Echinococcus granulosus (Dog Tapeworm)	• Dog • Human or man is going to be an accidental host	• Sheep	• Imaging - water lily sign • Arc5 immunoelectrophoresis • Casoni test: Obsolete (Type 1 HS) • FNAC: Contraindicated (Anaphylaxis)

Q1.6: What are the key structural features of cestode eggs?

Answer:

- All the cestodes have Hexacanth embryos (6 hooklet eggs)
- There are inner and outer membranes. Between them, there are small granules called yolk granules
- There are also two knobs known as **polar knobs/filaments**



Cestode Egg

Q1.7: What is the characteristic difference in the egg of H. dimunita from the rest of the cestodes?

Answer:

- There are no yolk granules
- No polar knobs or projections



Q1.8: Which parasites produce operculated eggs, and what is their structural feature?

Answer:

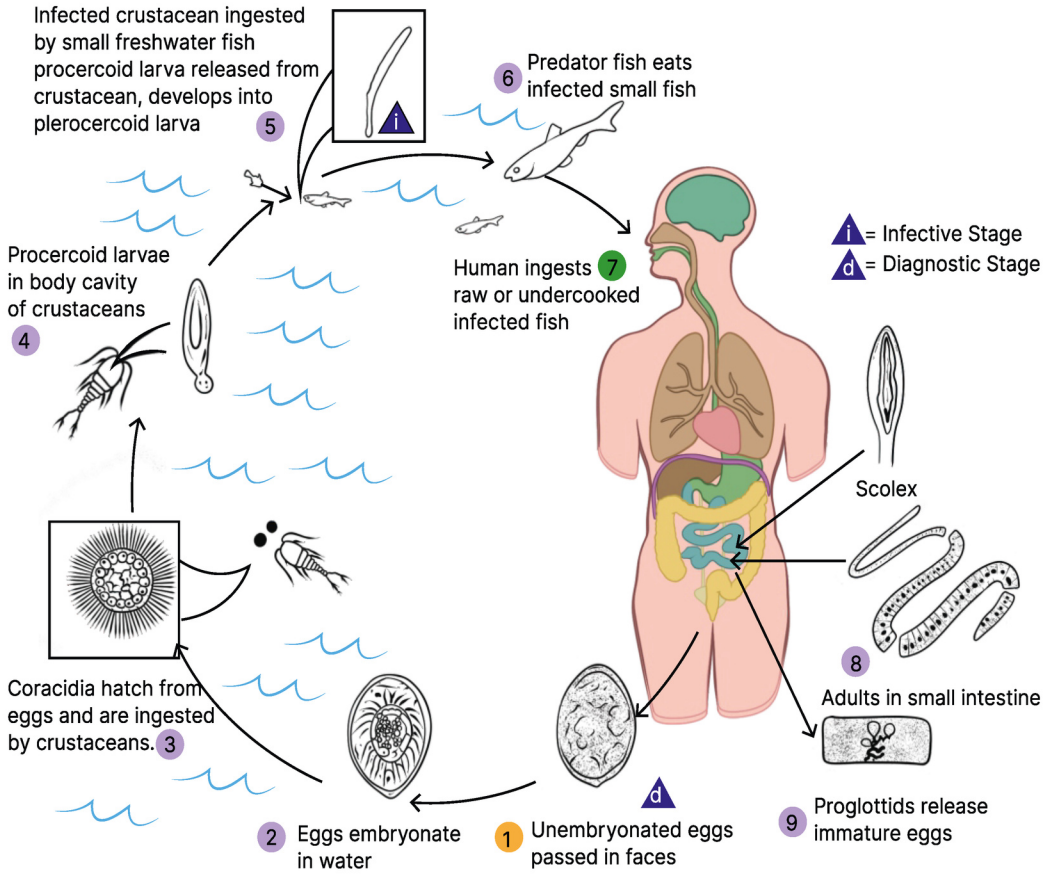
- Thin cap on the top
- The lid is like protection.
- Protection egg is seen in (mnemonic- **STD**)
  - **S** - Spirometra
  - **T** - Trematodes (except schistosoma)
  - **D** - **D**. Latum



Operculated egg

BIG QUESTION 2: Illustrate the life cycle of Diphyllobothrium latum.

Broad Answer:



DETAILED QUESTIONS

Q2.1: What is the other name for D. latum?

Answer:

Fish/broad tapeworm

Q2.2: Name the definitive and intermediate hosts of D. latum.

Answer:

- Definitive host - man, dog, cat (Optimal host - man)
- First intermediate host - fresh water copepod mainly cyclops
- Second intermediate host - freshwater fish

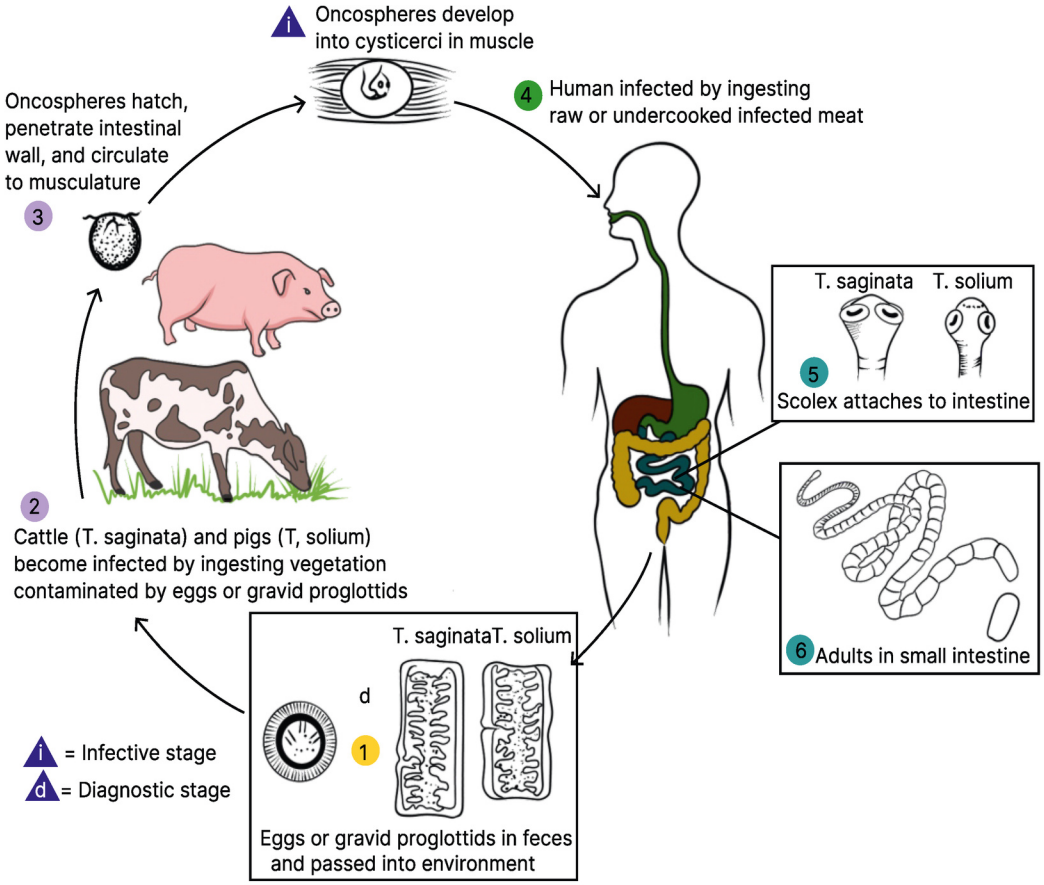
Q2.3: What is the infective form of D. latum?

Answer:

- Infective form: **L3 larva** known as **Plerocercoid larva**

BIG QUESTION 3: Illustrate the life cycle of Taenia solium and Taenia saginata.

Broad Answer:



DETAILED QUESTIONS

Q3.1: Tabulate the difference between Taenia solium and Taenia saginata.

Answer:

	Taenia Saginata (more)	Taenia Solium (less)
Length	• 5-10 meter	• 2-3 meter
Scolex	• Large quadrate • Rostellum and hooks are absent • Suckers may be pigmented	• Small and globular • Rostellum and hooks are present • Suckers not pigmented
Neck	• Long	• Short
Proglottids	• 1000-2000	• Below 1000
Measurement (gravid segment)	• 20mm × 5 mm	• 12mm × 6 mm
Expulsion	• Expelled singly	• Expelled passively in chains of 5 to 6
Uterus	• Lateral branches 15-30 on each side; thin and dichotomous	• Lateral branches 5-10 on each side; thick and dendritic
Vagina	• Present	• Absent
Testes	• 300-400 follicles	• 150-200 follicles
Larva	• Cysticercus bovis: Present in cows not in man	• **Cysticercus cellulosae: Present in pig and man**

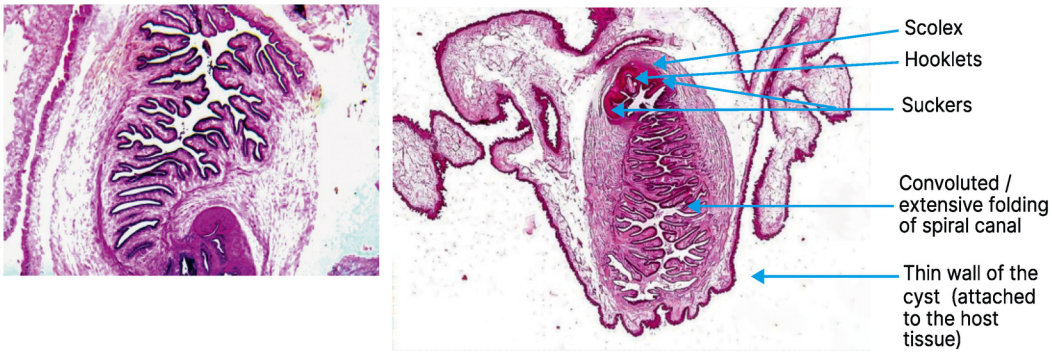
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Egg	• Not infective to man	• Infective to man
Infection	• Intestinal	• Intestinal Cysticercosis/Neurocysticercosis

- It has one pig (T. Solium) and one cattle (T. saginata)
- In the head end, if there are suckers with hooks, it is solium. Whereas, saginata will have only suckers
- If there are six hooklets in eggs, it is of the cestode family

Q3.2: What is the histopathological feature seen in cysticercus cellulosae?

Answer: At the head end, there is a zig-zag, there will be hooklets and suckers, and a convoluted tube-like structure, this will be Cysticercus cellulosae



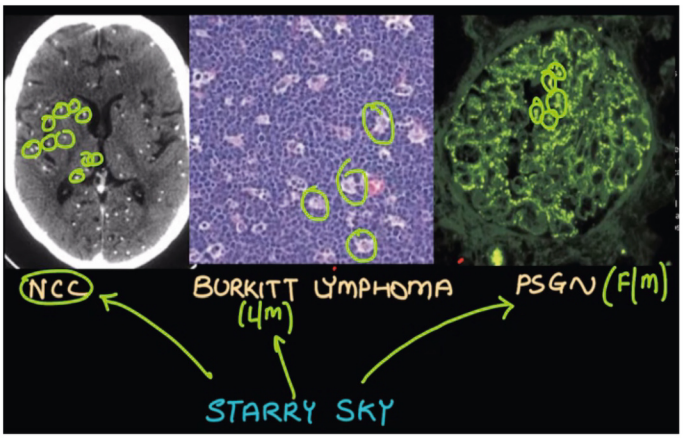
Q3.3: Write briefly about site, presentation, imaging appearance, and treatment of Neurocysticercosis.

Answer:

- Most common site: Brain parenchyma
- Most common presentation: Seizures
- Shows starry sky appearance on NCCT
- Treatment: Praziquantel

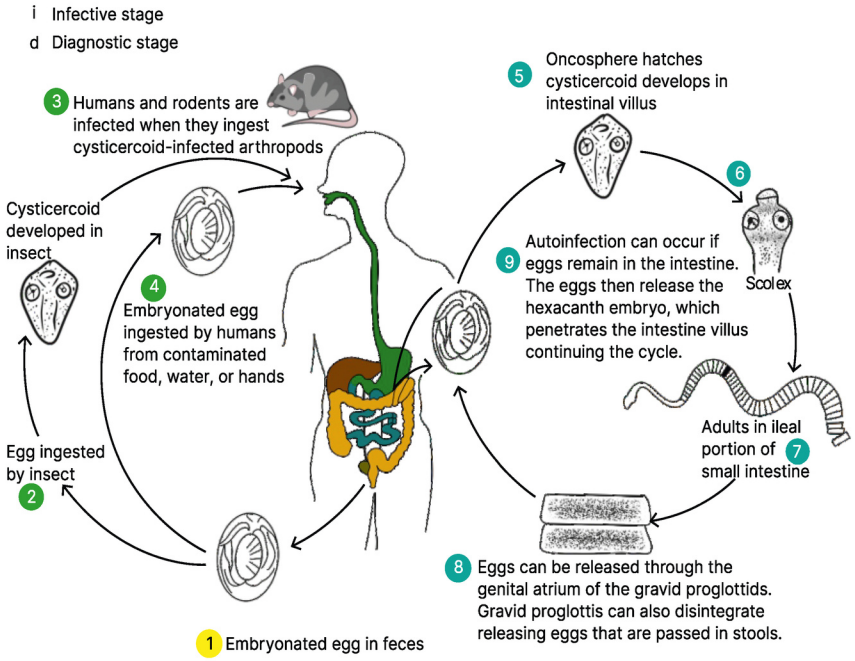
Q3.4: What are the other conditions where a starry sky appearance is seen?

Answer:



BIG QUESTION 4: Illustrate the life cycle of Hymenolepis Nana and H. diminuta.

Broad Answer:



DETAILED QUESTIONS

Q4.1: What is the other name of H. nana?

Answer: Dwarf tapeworm

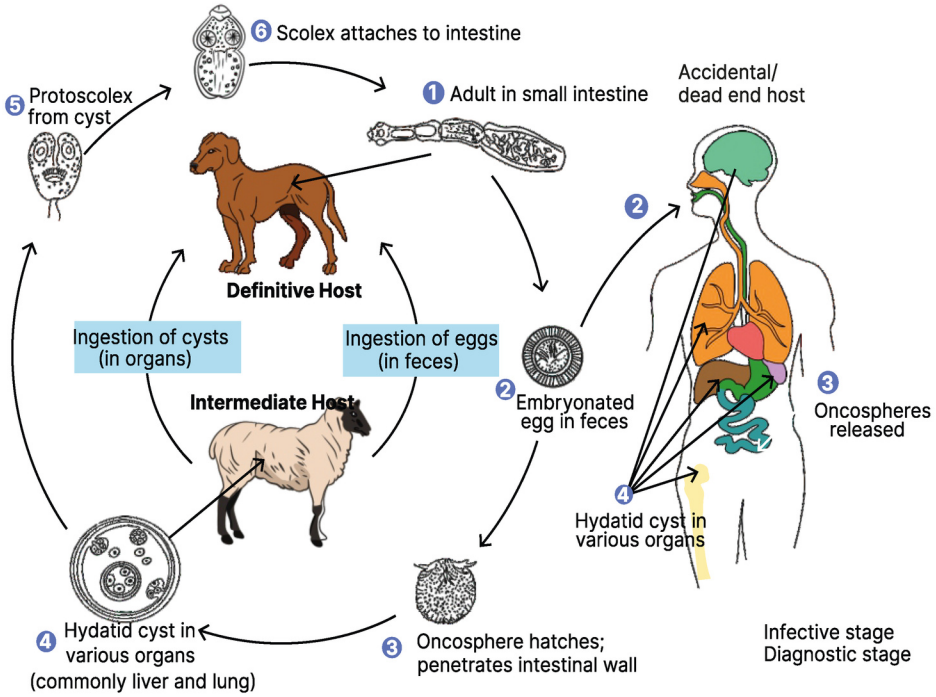
Q4.2: Name the host of H. nana.

Answer:

- Host - man
- No intermediate host

BIG QUESTION 5: Illustrate the life cycle of Echinococcus granulosus.

Broad Answer:



DETAILED QUESTIONS

Q5.1: Write a short note on the habitat of Echinococcus granulosus.

Answer:

- Also known as the dog tapeworm
- The adult worm lives in the jejunum and duodenum of dogs
- Larval stage - humans and herbivorous animals (sheep, goat, cattle, horse)

Q5.2: Name the definitive, intermediate and accidental hosts of E. granulosus.

Answer:

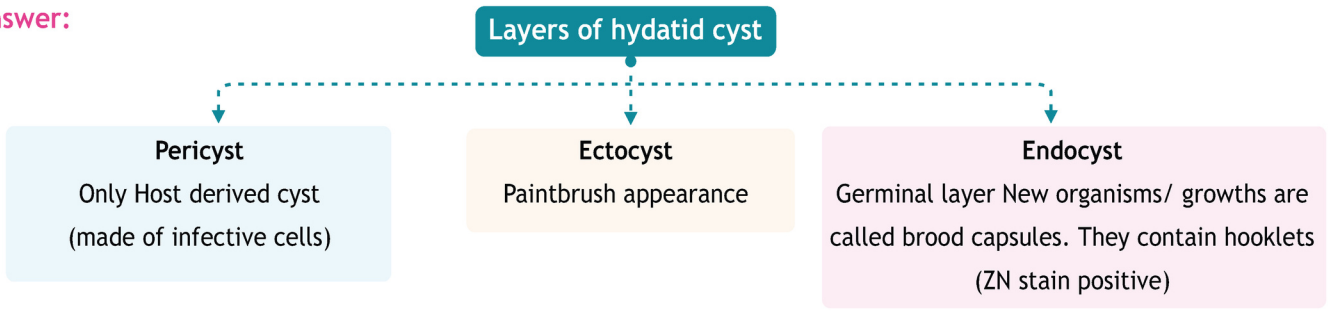
- Definitive host - Dog
- Intermediate host - Sheep and cattle
- Accidental/dead-end host - Man

Q5.3: Which parasite causes a Hydatid cyst?

Answer: Echinococcus granulosus

Q5.4: What are the layers of a hydatid cyst?

Answer:

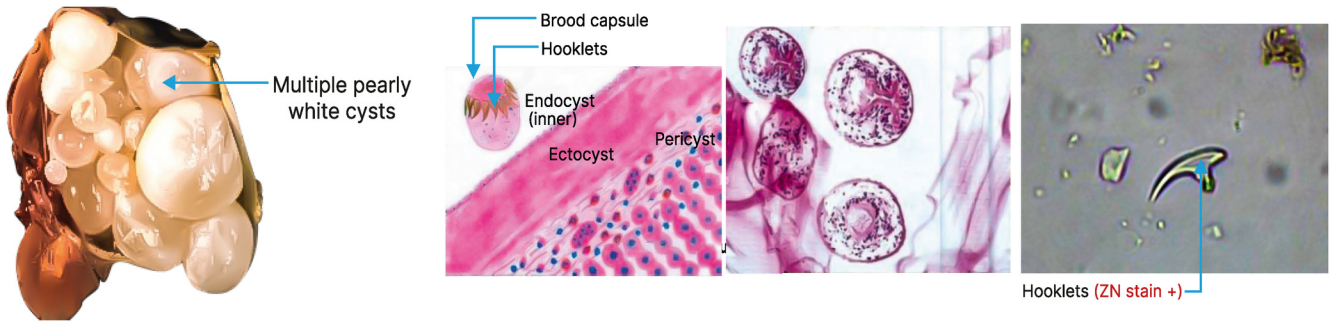


Q5.5: What are the common sites, gross appearance, and microscopic features of hydatid cysts caused by Echinococcus granulosus?

Answer:

PYQ: AIIMS 2022

- Most common site: Liver
- Second most common site: Lungs



Q5.6: What is the treatment for Echinococcus granulosus?

Answer:

- Mnemonic: **PAIR**
  - **P** - Puncture of cyst
  - **A** - Aspirate
  - **I** - Injection 95% ethanol (Scolicidal)
  - **R** - Re-aspiration

YOURWISH

Q5.7: What is meant by multilocular hydatid cyst in Echinococcus multilocularis, and which sites are most commonly affected?

Answer:

- Echinococcus multilocularis causes multilocular (alveolar) hydatid cysts, so called because of their multiple compartment-like structure
- Most common site: Liver
- Second most common site: Lungs

BIG QUESTION 6: Write a brief description about Trematodes and the diseases caused by them.

Broad Answer: Trematodes, also known as **flukes**, are flat, leaf-shaped parasitic worms that belong to the class **Trematoda**. They have a complex life cycle involving one or more intermediate hosts, usually **snails**, and infect various organs such as the liver, lungs, or intestines. Common examples include **Schistosoma** (blood fluke), **Fasciola hepatica** (liver fluke), and **Paragonimus westermani** (lung fluke)

DETAILED QUESTIONS

Q6.1: Tabulate the differences between the different types of hosts in Trematodes.

Answer: PYQ: NEET PG 2023 PYQ: AIIMS 2021

Trematode	Aka	Definite host	First intermediate host	Second intermediate host
Schistosoma	Blood fluke	Man	Snail	_
Paragonimus Westermani	Lung/pulmonary fluke	Man	Snail	Crab Crayfish
Clonorchis Sinensis	Liver fluke	Man	Snail	Fish
Opisthorchis		Man	Snail	Fish
Fasciola hepatica	Sheep liver fluke	Sheep/man	Snail	Fresh aquatic vegetation
Fasciolopsis buski	Intestinal fluke	Man	Snail	Fresh aquatic vegetation

Q6.2: Tabulate the differences between different types of Trematodes with respect to infective form, mode of transmission of infection, types of adult worms, their eggs and the treatments. PYQ: FMGE 2023

Answer:

Trematode	Infective form	Transmission	Adult worms	Eggs	Treatment
Schistosoma	Cercaria larva (forked tail)	Skin penetration	Sex Separate	Spinous egg	Praziquantel
Paragonimus westermani	Metacercaria larva	Ingestion	Hermaphrodites	Operculated egg-lid one	Praziquantel
Clonorchis sinensis	Metacercaria larva	Ingestion	Hermaphrodites	Operculated egg-lid one	Praziquantel
Opisthorchis	Metacercaria larva	Ingestion	Hermaphrodites	Operculated egg-lid one	Praziquantel

YOURWISH

Fasciola hepatica	Metacercaria larva	Ingestion	Hermaphrodites	Operculated egg-lid one	Triclabendazole
Fasciolopsis buski	Metacercaria larva	Ingestion	Hermaphrodites	Operculated egg-lid one	Praziquantel

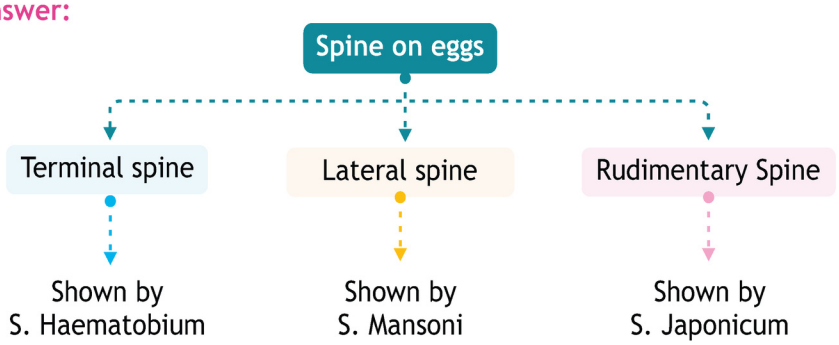
Q6.3: Name the organisms where operculated eggs with lids are seen.

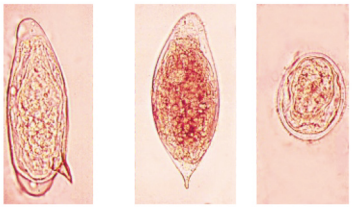
Answer:

- Operculated eggs- With lids
- Mnemonic: **STD**
  - **S -S**pirometra
  - **T - T**rematodes except Schistosoma - it will show a spinous egg
  - **D - D**. Latum

Q6.4: Write a note on the location of spines on the eggs of Schistosoma spp.

Answer:





Q6.5: What are the clinical features and complications of Schistosoma haematobium infection?

Answer:

- Causes hematuria
- Affects the urinary bladder→ increases risk of squamous cell carcinoma > transitional cell carcinoma
- Parasite travels into the vesical venous plexus

Q6.6: What is the site of involvement and venous drainage pathway of Schistosoma mansoni?

Answer:

- Travels into the inferior mesenteric venous plexus
- Involves the sigmoid colon and rectum

Q6.7: What are the sites of involvement and complications of Schistosoma japonicum infection?

Answer:

- Travels into the superior mesenteric venous plexus
- Involves the ileo-caecal region
- Can cause CNS involvement & genital involvement

Q6.8: What organs are commonly involved in Paragonimus westermani infection?

Answer:

- Pulmonary involvement
- Gastrointestinal tract involvement

Q6.9: What are the major complications associated with Clonorchis and Opisthorchis infections?

Answer:

- Cholangitis
- Cholangiocarcinoma

Q6.10: What are the clinical features of Fasciola hepatica infection?

Answer:

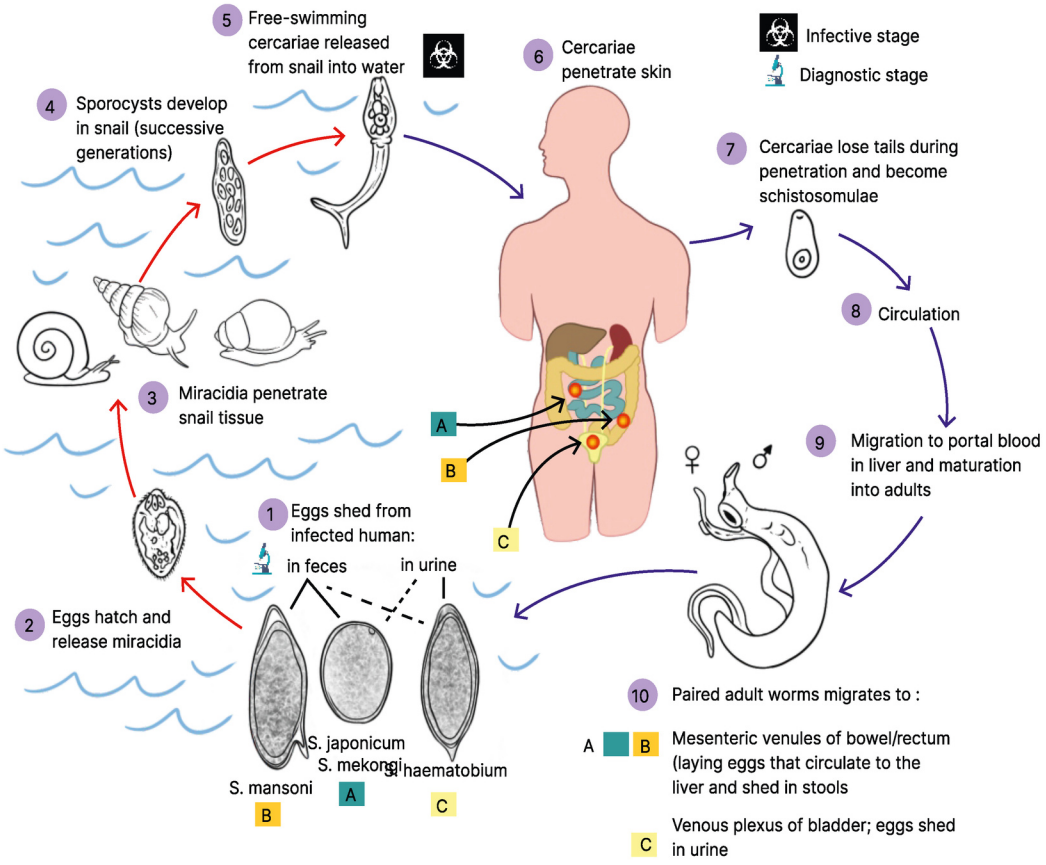
- Jaundice
- Right-sided abdominal pain
- Halzoun - suffocation due to pharyngeal & laryngeal edema

Q6.11: What is the site of infection of Fasciolopsis buski?

Answer: Small intestine (intestinal fluke)

BIG QUESTION 7: Illustrate the life cycle and few characteristic features of Schistosoma.

Broad Answer:



- If there is only a human and a snail in the life cycle, then it is Schistosoma
- Cercaria larva that comes through skin penetration
- Sexes are separate
- Spinous egg is a case of Schistosoma

DETAILED QUESTIONS

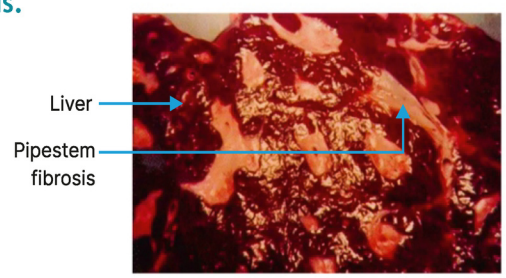
Q7.1: What is the disease caused by Schistosoma called?

Answer: Schistosomiasis/ Bilharziasis

Q7.2: Tabulate the differences between acute and chronic schistosomiasis.

Answer:

Acute Schistosomiasis	Chronic Schistosomiasis
• Katayama-like fever: Serum sickness-like illnes	• Granuloma • Pipestem fibrosis (periportal)



Q7.3: What is the developmental sequence of trematode eggs?

Answer:

- Mnemonic: **MCRCM**
  - **M** -Miracidia
  - **C** - Cyst
  - **R** - Redia
  - **C** - Cercaria larva
  - **M** - Metacercaria larva

Q7.4: What is the developmental sequence of Schistosoma?

Answer: In Schistosoma, there's only **MCC**

- **M** -Miracidia
- **C** - Cyst
- **C** - Cercaria larva

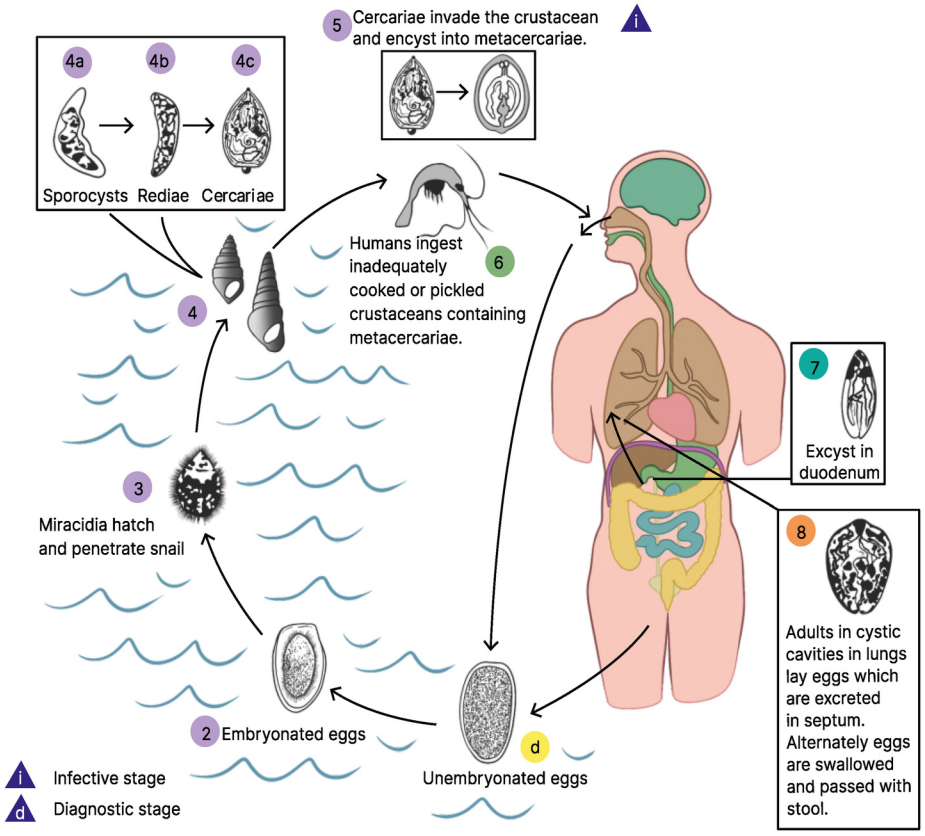
Q7.5: Redia is not seen in which of the trematode cycles?

Answer: Schistosoma

BIG QUESTION 8: Illustrate the life cycle of Paragonimus Westermani.

PYQ: FMGE 2019

Broad Answer:



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DETAILED QUESTIONS

Q8.1: How are Paragonimus westermani eggs released and excreted from the human body?

Answer:

- Lifecycle involves snail + crab/crayfish + humans
- Unembryonated eggs escape into the bronchi
- Eggs are coughed up and voided in sputum or swallowed and passed in faeces

Q8.2: What is the other name for Paragonimus Westermani?

Answer: Oriental lung fluke

Q8.3: Name the definitive and intermediate hosts.

Answer:

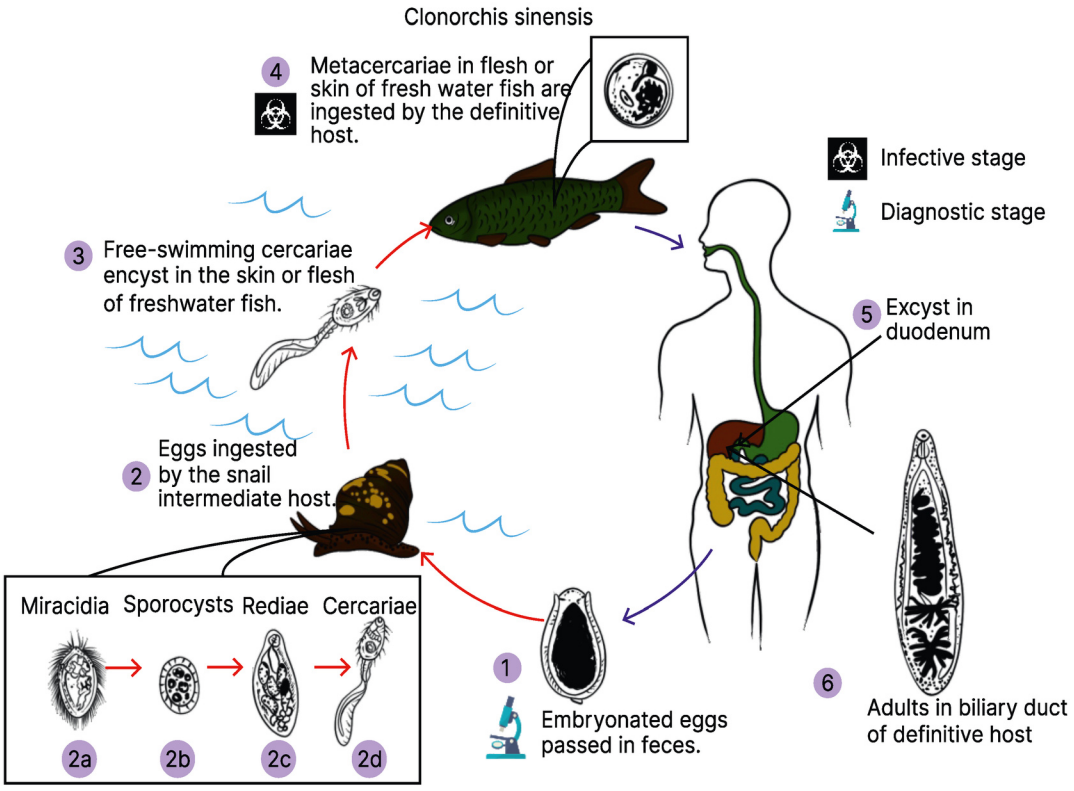
- Definitive host - Man
- First intermediate host - Freshwater snail
- Second intermediate host - Freshwater crab or crayfish

Q8.4: What is the mode of transmission?

Answer: Man acquires infection by eating undercooked crab or crayfish containing metacercariae

BIG QUESTION 9: Illustrate the life cycle of Clonorchis sinensis.

Broad Answer:



- If there is a snail, fish, or human, it is Clonorchis or Opisthorchis
- Clonorchis and Opisthorchis cause cholangitis and cholangiocarcinoma

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YOURWISH

DETAILED QUESTIONS

Q9.1: What are the major diseases caused by Clonorchis and Opisthorchis infections?

Answer:

- Cholangitis
- Cholangiocarcinoma

Q9.2: What are the common names for various liver flukes?

Answer:

- Clonorchis sinensis: Chinese liver fluke
- Opisthorchis viverrini: Southeast Asian liver fluke
- Opisthorchis felineus: Cat liver flukes
- Fasciola hepatica: Sheep liver fluke
- Fasciola gigantica: Giant liver fluke

Q9.3: Name the intestinal trematodes.

Answer:

- Fasciolopsis Buski (giant intestinal fluke)
- Heterophyes (small intestinal fluke)
- Metagonimus yokogawai (small intestinal fluke)
- Echinostoma ilocanum (small intestinal fluke)
- Gastrodiscoides hominis (involves the large intestine)

BIG QUESTION 10: What are nematodes, and can you give examples of diseases they cause?

Broad Answer: Nematodes, also known as **roundworms**, are unsegmented, cylindrical helminths with a complete digestive system. They can infect the gastrointestinal tract, blood, or tissues and are transmitted through soil, contaminated food, or insect vectors. Common examples include **Ascaris lumbricoides**, **Enterobius vermicularis**, and **Wuchereria bancrofti**, causing diseases like ascariasis, pinworm infection, and filariasis

DETAILED QUESTIONS

Q10.1: Classify nematodes based on their habitat.

Answer:

PYQ: NEET PG 2021 PYQ: AIIMS 2018, 2020, 2021

Intestinal	Somatic
Small Intestine • Roundworm • Hookworm • Strongyloides Also have Lung stage	• Filaria • Trichinella • Dracunculus
Large intestine • Trichuris • Enterobius	

Q10.2: Classify the nematodes based on their eggs/larvae.

Answer:

Viviparous	Oviparous	Ovoviviparous
Larva	Egg → larva (later)	Egg → larva (immediately)
• Filaria • Trichinella • Dracunculus	• Roundworm • Hookworm • Trichuris • Enterobius	• Strongyloides

Q10.3: What are the characteristics of Ascaris lumbricoides eggs?

Answer:

- **Shape:** Round
- **Types:** Fertilized or unfertilized eggs
- **Fertilized eggs:**
  - Thick albumin coat
  - Crescentic space present
  - Float in a saturated salt solution
- **Unfertilized eggs:**
  - Do not float in a saturated salt solution

Ascaris lumbricoides Eggs



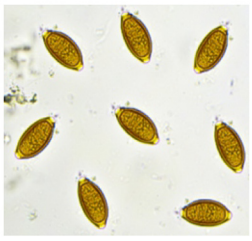
FERTILIZED UNFERTILIZED

Q10.4: Which parasite produces barrel-shaped eggs with two mucus plugs?

Answer:

- **Parasite:** Trichuris trichiura
- **Egg feature:** Barrel-shaped with two mucus plugs

Trichuris Trichiura

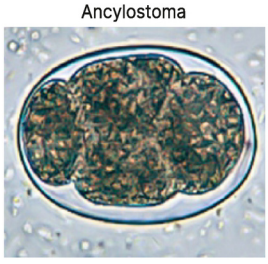


Q10.5: What are the characteristics of hookworm (*Ancylostoma*) eggs?

Answer:

- **Type:** Segmented eggs
- **Contain:** Blastomeres

Ancylostoma



Q10.6: What are the characteristics of Enterobius vermicularis eggs?

Answer:

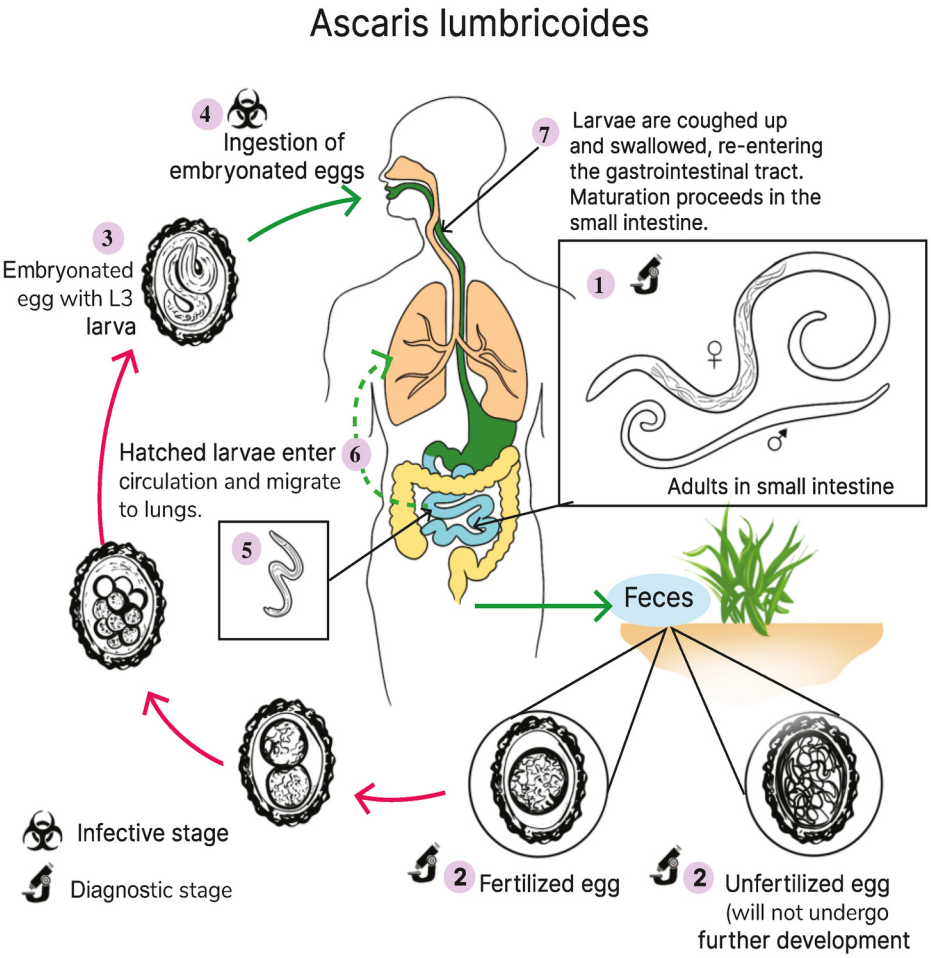
- **Shape:** Plano-convex
- **Larva:** Contains tadpole larvae

Enterobius vermicularis



BIG QUESTION 11: Illustrate the life cycle of Ascaris Lumbricoides.

Broad Answer:

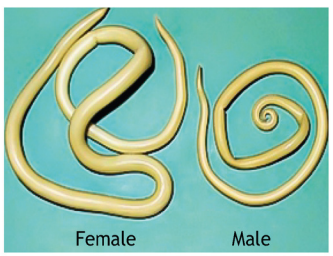


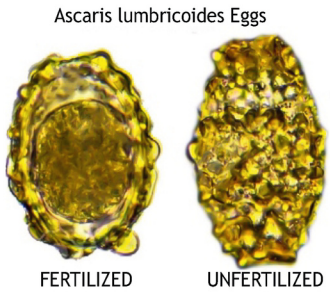
DETAILED QUESTIONS

Q11.1: What are the transmission, infective stage, diagnostic stage, clinical features, and treatment of Ascaris lumbricoides infection?

Answer:

Organism	Mode of transmission	Infective stage	Diagnostic stage	Clinical	Treatment
Ascaris Lumbricoides (roundworm)	Ingestion	Embryonated egg	Fertilized and unfertilised eggs	Malabsorption loeffler's pneumonitis	Albendazole





- In Ascaris, the larger/longer worm is female, and the male worm has a coiled posterior end

YOURWISH

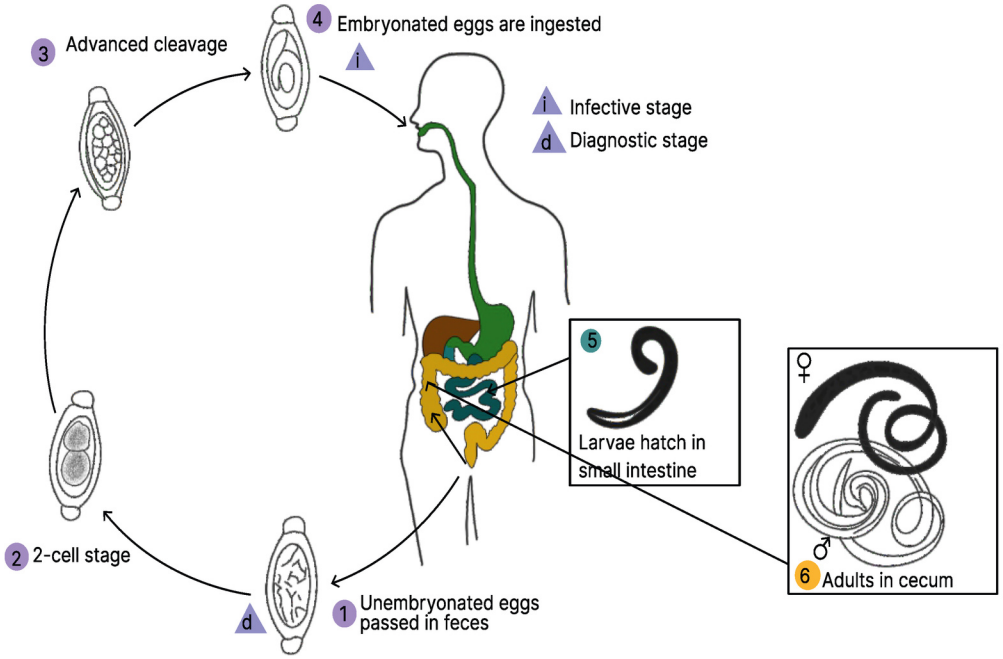
Q11.2: What types of eggs does Ascaris lumbricoides produce, and what conditions can the infection cause?

Answer:

- **Egg types:** Fertilized and unfertilized
- **Clinical features:**
  - Malabsorption
  - Loeffler's pneumonitis

BIG QUESTION 12: Illustrate the life cycle of Trichuris trichura.

Broad Answer:



DETAILED QUESTIONS

Q12.1: Write a note on the mode of transmission, infective stage, clinical features and treatment of trichuris.

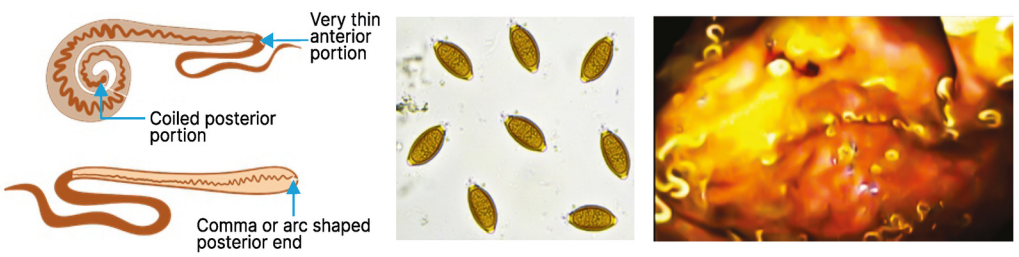
Answer: PYQ: NEET PG 2019 2020

Organism	Mode of transmission	Infective stage	Diagnostic stage	Clinical	Treatment
Trichuris trichiura (whipworm)	Ingestion	Embryonated egg	Unembryonated eggs	• Dysentery • Rectal prolapse • Coconut cake rectum	Albendazole

Q12.2: Describe briefly about the adult worms and their eggs.

Answer:

- The posterior end is coiled in a male worm
- Eggs are barrel-shaped with mucus plugs
- The unembryonated eggs will be passed down in the stool

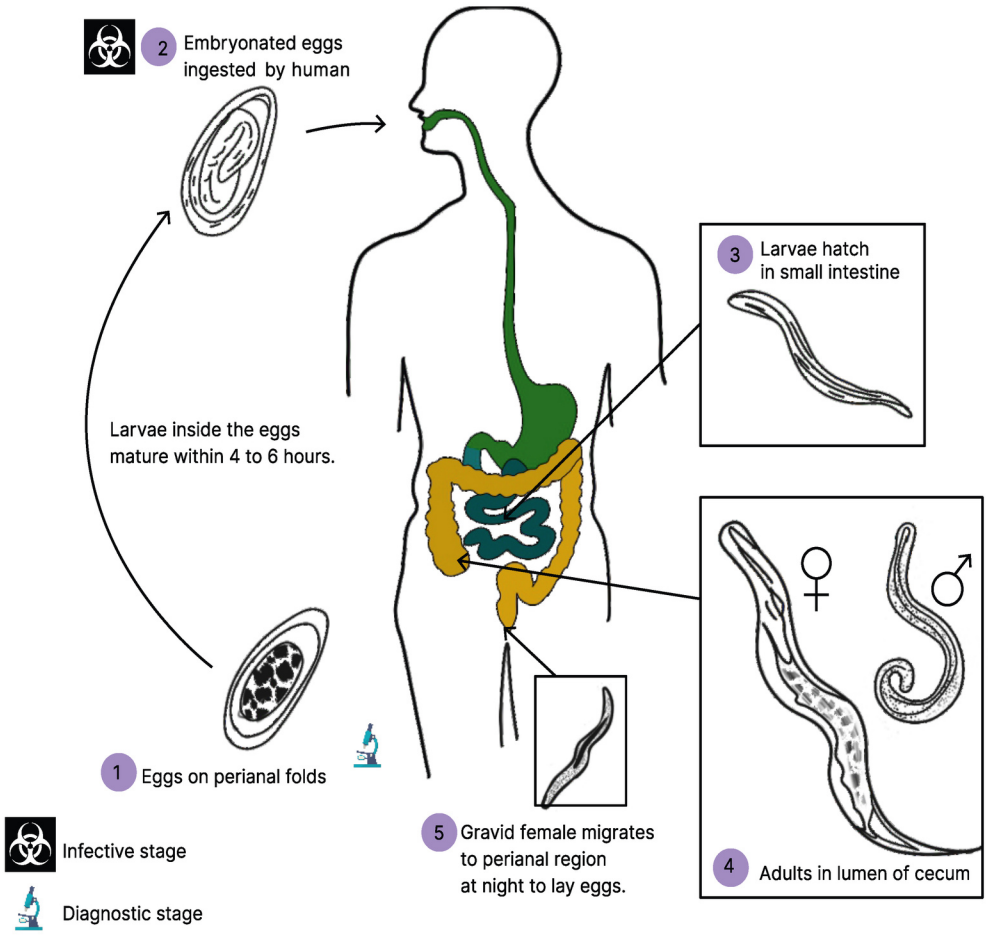


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BIG QUESTION 13: Illustrate the life cycle of Enterobius vermicularis.

Broad Answer:



DETAILED QUESTIONS

Q13.1: Elaborate on the transmission, infective stage, diagnostic stage, clinical features, and treatment of Enterobius vermicularis infection.

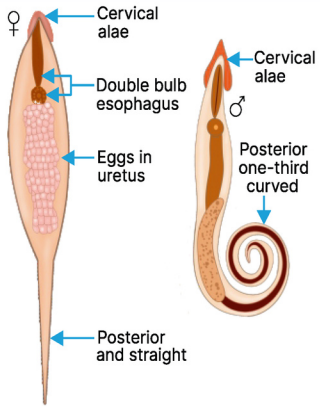
Answer:

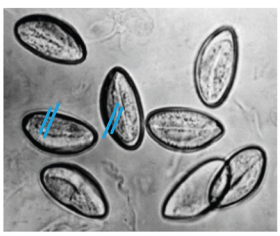
Organism	Mode of transmission	Infective stage	Diagnostic stage	Clinical	Treatment
• Enterobius vermicularis (pinworm/ threadworm)	• Ingestion	• Emb-ryonated egg	• Emb-ryonated eggs	• Perianal pruritus, • Perianal swab (NIH swab), or • Scotch tape method	• Albendazole

Q13.2: Describe the adult worms and eggs of Enterobius.

Answer:

- Attaches to the Vermiform appendix.
- The posterior end is coiled in male worms, whereas female worms are larger.
- There are three projections on the organism known as the Cervical alae.

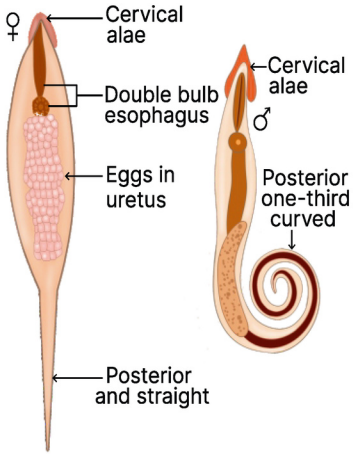


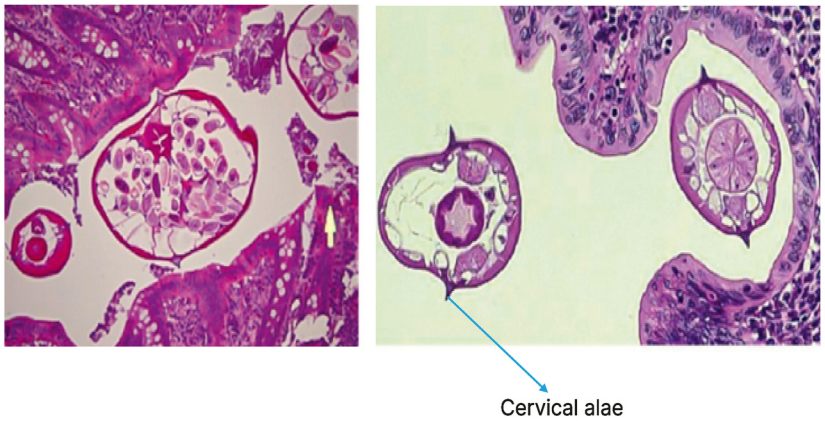


Q13.3: What are the unique features and diagnostic methods for Enterobius vermicularis infection?

Answer:

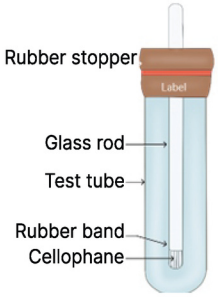
- **Unique feature:** The Only organism with **cervical alae**
- **Diagnosis:**
  - A biopsy of the appendix can reveal infection
  - Perianal swab (NIH swab) or Scotch tape method for detecting eggs
- **Lifecycle note:**
  - The male dies after mating
  - The female travels to the anal canal to lay eggs

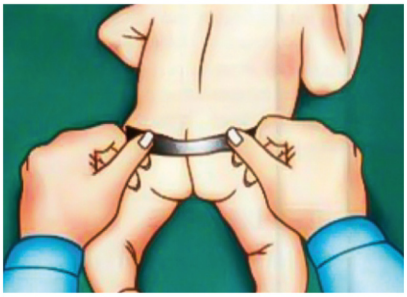


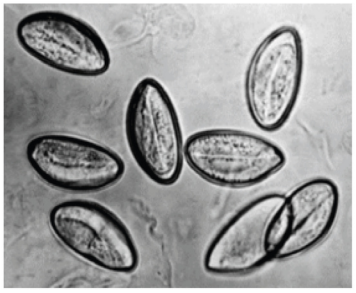


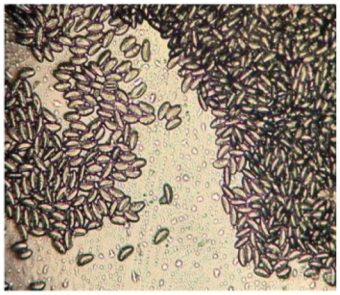
Q13.4: Describe the NIH swab method used in Enterobius?

Answer:









- Eggs visualised by Perianal swab (NIH swab) or scotch tape method

Q13.5: How does autoinfection occur in *Enterobius vermicularis* infection?

Answer:

Person scratches the perianal area with fingers

↓

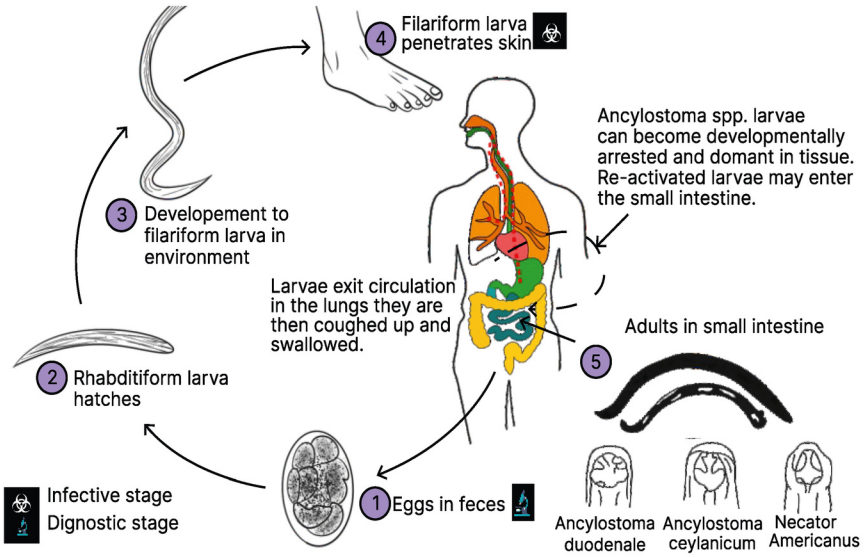
Contaminated fingers touch food

↓

Ingestion of eggs from contaminated hands leads to **autoinfection**

BIG QUESTION 14: Illustrate the life cycle of Ancylostoma duodenale.

Broad Answer:





DETAILED QUESTIONS

Q14.1: What is the mode of transmission, infective stage, diagnostic stage, clinical features and treatment of hookworms?

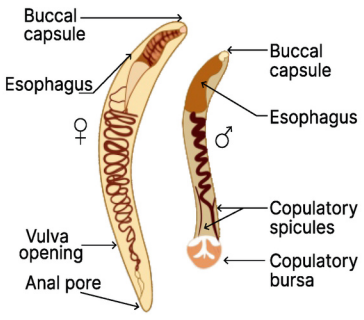
Answer:

Organism	Mode of transmission	Infective stage	Diagnostic stage	Clinical	Treatment
• Ancylostoma duodenale • (Old world hookwor) • Necator americanus • New world hookworm	• Skin	• Filariform larva	• Embryonated eggs	• Ground itch • Creeping eruption IDA	• Albendazole

Q14.2: Write a short note on adult worms and eggs of hookworms.

Answer:

- Filariform larva enters the human body via skin penetration (creeping eruption)
- If there are hookworm eggs, it is Ancylostoma duodenale.
- From the hookworm eggs, a Rhabditiform larva hatches, later forming a filariform larva.
- IDA is associated with hookworm. recall: vit B12 deficiency is a/w D. latum.




Egg with blastomeres

- Here, in males there is no coiling. There will be an umbrella like a flattening- Copulatory Bursa.

Q14.3: Name the organisms that infect humans via skin penetration.

Answer:

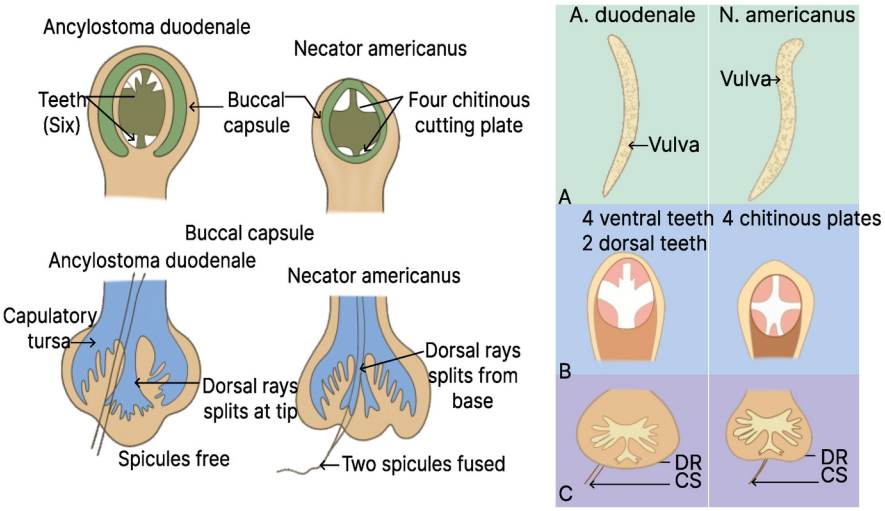
- Skin penetration (mnemonic: **SAS**)
  - o **S**chistosoma
  - o **A**ncylostoma (hookworm)
  - o **S**trongyloides

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Q14.4: Differentiate Ancylostoma duodenale and Necator americanus based on adult worm morphology, filariform larva, and pathogenicity.

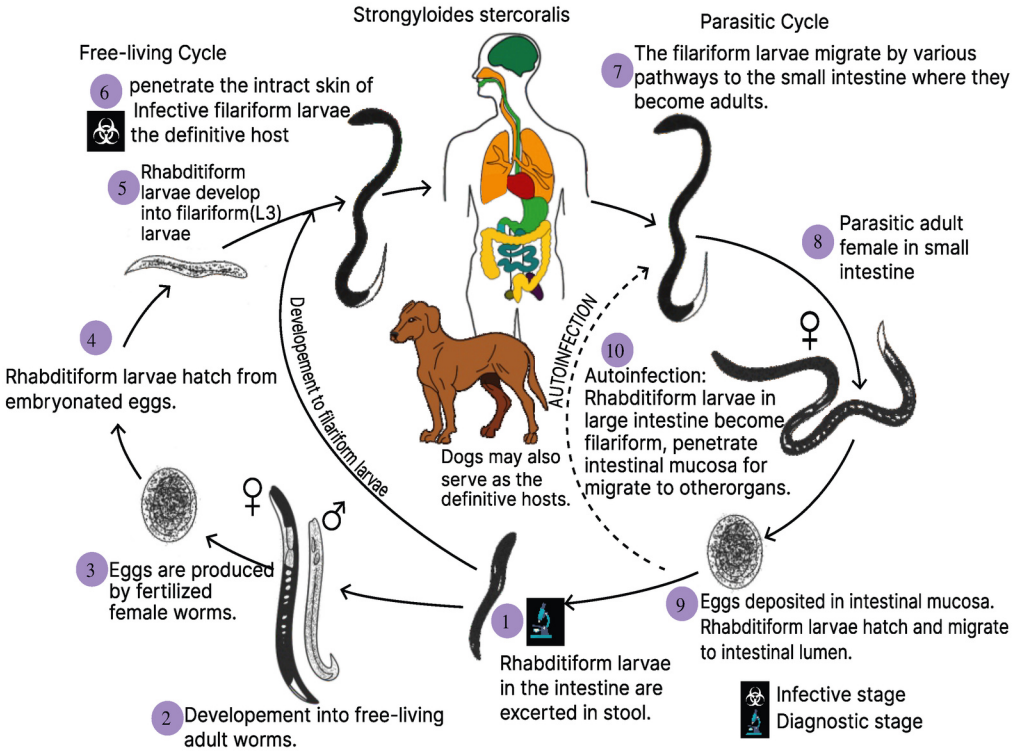
Answer:

Feature	Ancylostoma duodenale	Necator americanus
Common name	Old World hookworm	New World hookworm
Eggs	Same	Same
Rhabditiform larva	Same	Same
Adult worms	Six teeth in buccal capsule; two spicules free	Four chitinous cutting plates in the buccal capsule; two spicules fused
Filariform larva	Different (less pointed tail)	Different (more pointed tail)
Pathogenicity	More pathogenic	Less pathogenic; ground itch is more severe



BIG QUESTION 15: Illustrate the life cycle of Strongyloides stercoralis.

Broad Answer:



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DETAILED QUESTIONS

Q15.1: What a note on the mode of transmission, infective stage, diagnostic stage, clinical features and treatment.

Answer:

Organism	Mode of transmission	Infective stage	Diagnostic stage	Clinical	Treatment
• Strongyloides • Stercoralis • (Smallest nematode)	• Skin	• Filariform larva	• Rhabditiform larva	• Causes Cutaneous larva migrans	• Ivermectin

Q15.2: Describe briefly about the life cycle of Strongyloides stercoralis.

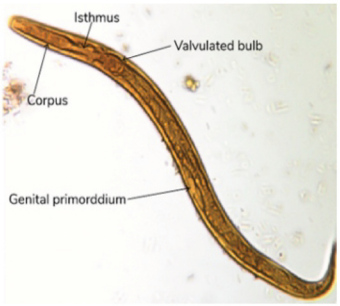
Answer:

- Filariform larvae will enter the body
- Eggs will be laid down and are immediately hatched into Rhabditiform larvae
- It causes cutaneous larva migrans
- Females can undergo asexual reproduction called parthenogenesis
- After the birth, the same larva can enter the body via autoinfection
- Direct cycle:
  - Rhabditiform will directly form filariform larvae
- Indirect cycle (long route):
  - Male and female parents lay eggs that form Rhabditiform larvae, which in turn form filariform larvae

Q15.3: How will you identify rhabditiform larvae?

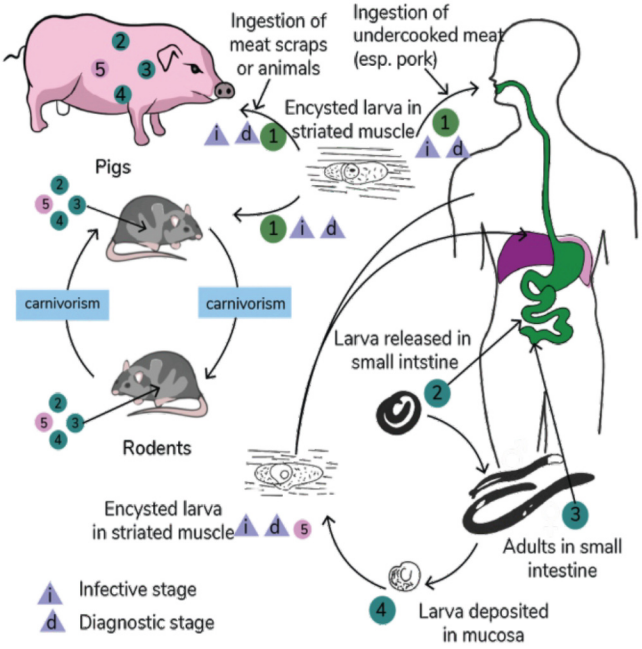
Answer:

- Rhabditiform larvae are identified by the isthmus and double-bulbed oesophagus.



BIG QUESTION 16: Illustrate the life cycle of Trichinella spiralis.

Broad Answer:

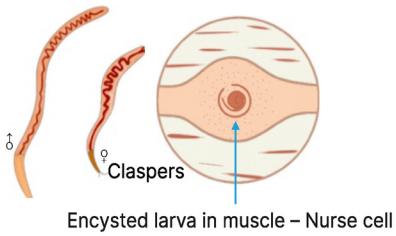


DETAILED QUESTIONS

Q16.1: Draw the adult worms of Trichinella spiralis.

Answer:

- Claspers in males hold females during mating.



Q16.2: Describe the mode of transmission, infective stage, diagnostic stage and treatment of Trichinella spiralis.

Answer:

Organism	Mode of transmission	Infective stage	Diagnostic stage	Treatment
• Trichinella Spiralis	• Ingestion of meat • Host - pig • Alternate/dead end- human	• Encysted larva	• Biopsy	• Albendazole

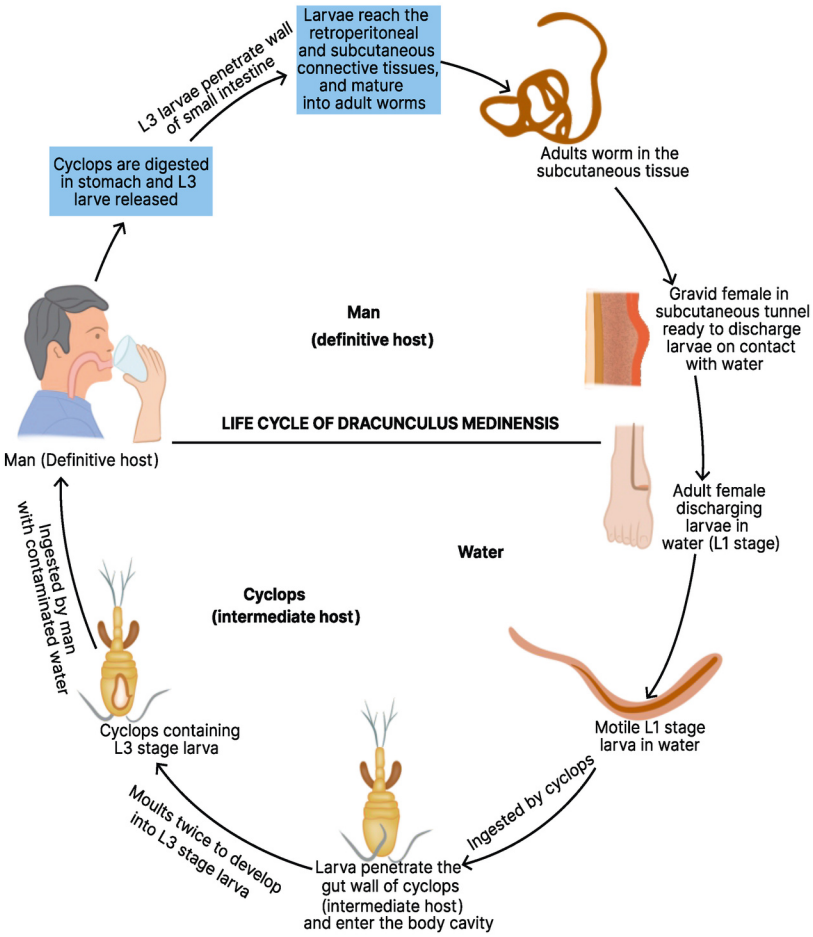
Q16.3: What are the key features of encysted larva in Trichinella spiralis infection?

Answer:

- In pigs, it will be present in the muscles
- In humans, it will be present in muscles
- Muscles nourish (nurse cell) the encysted larva
- Thus, muscle biopsy is diagnostic
- It is also capable of causing **myocarditis**

BIG QUESTION 17: Illustrate the life cycle of Dracunculus medinensis

Broad Answer:



DETAILED QUESTIONS

Q17.1: What is the mode of transmission, infective stage, and diagnostic stage of Dracunculus?

Answer:

Organism	Mode of transmission	Infective stage	Diagnostic stage
• **Dracunculus Medinensis** (Guinea worm eradicated)	• Drinking water with cyclops having L3 larva	• L3 larva	• Larva emerging from the skin

Q17.2: How was guinea worm eradicated?

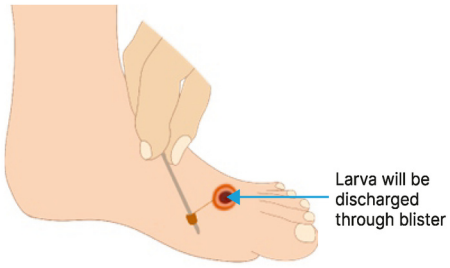
Answer:

- Guinea worm is transmitted by drinking dirty water containing cyclops (L3 larvae)
- It has been eradicated because of clean drinking water

Q17.3: How does the larva come out through the skin?

Answer:

- L3 larvae will make adult worms
- After mating, gravid females will give birth in the Subcutaneous region
- While giving birth, the larva will come out through the blister



BIG QUESTION 18: Describe briefly about filarial worms.

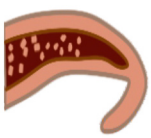
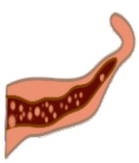
Broad Answer: Filarial worms are **thread-like parasitic nematodes** that infect the lymphatic system, subcutaneous tissue, or body cavities of humans and are transmitted by **blood-feeding insects** like mosquitoes and flies. They cause diseases such as **lymphatic filariasis** (e.g., *Wuchereria bancrofti*, *Brugia malayi*) and **onchocerciasis** (*Onchocerca volvulus*). These infections can lead to chronic conditions like **elephantiasis** or **river blindness**.

DETAILED QUESTIONS

Q18.1: Tabulate the differences in shape and posterior end of different species of filaria.

Answer:

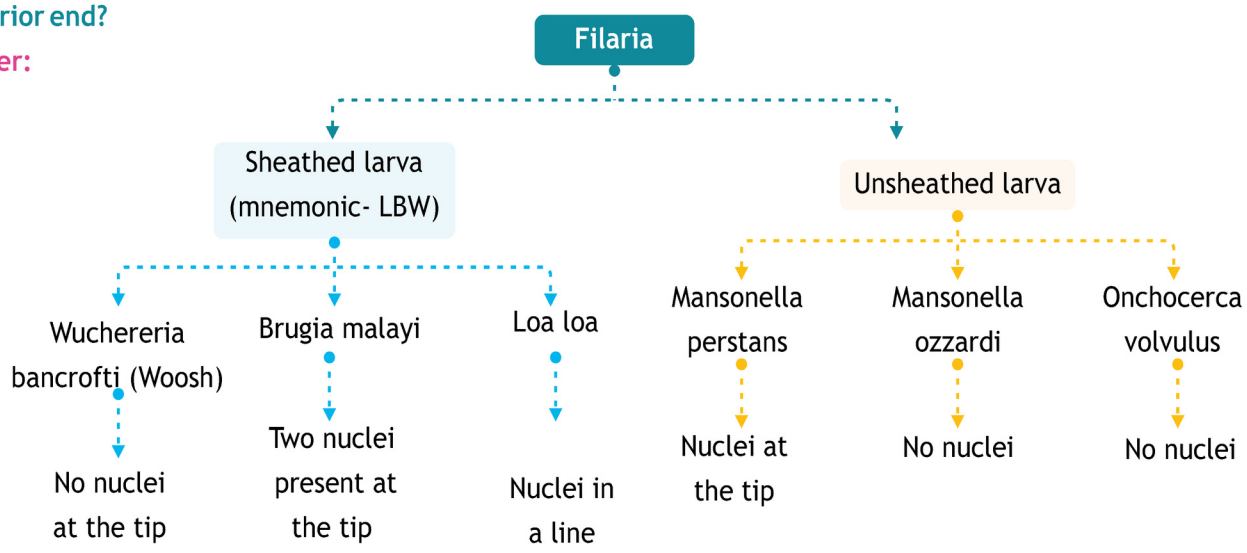
PYQ: FMGE 2019 PYQ: NEET PG 2020, 2021, 2022, 2023

Species	Wuchereria bancrofti	Brugia malayi	Loa loa	Mansonelia prestans	Mansonella ozzardi	Onchocerca volvulus
Shape						
Posterior end						

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Q18.2: How would you differentiate the different species of filaria based on the sheathing and nuclei in the posterior end?

Answer:



Q18.3: What is the periodicity of microfilariae in different filarial species?

Answer:

- Wuchereria bancrofti - nocturnal
- Brugia malayi- nocturnal
- B. timori- nocturnal
- Loa loa- diurnal
- Onchocerca volvulus- nonperiodic
- Mansonella- nonperiodic

Q18.4: Name the vectors for different filarial species.

Answer:

- Vectors:
  - Wuchereria bancrofti- culex, anopheles, Aedes
  - Brugia malayi- mansonia
  - B. timori- anopheles
  - Loa loa- deer flies (chrysops)
  - Onchocerca volvulus- blackflies (black skin)
  - Mansonella- midges

Q18.5: What are the key clinical features of lymphatic filariasis caused by Wuchereria bancrofti?

Answer:

- **Lymphatic obstruction** → causes Elephantiasis
- **Chyle in urine** → known as Chyluria



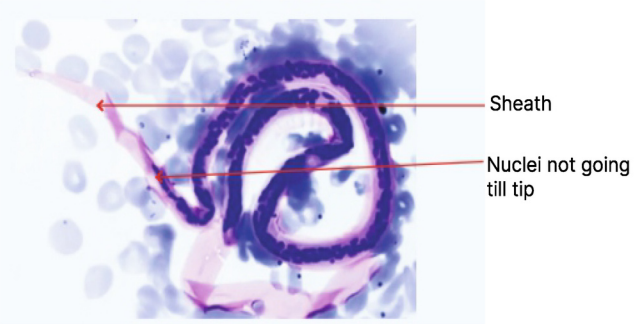
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Q18.6: What are the laboratory diagnostic methods for lymphatic filariasis (Wuchereria bancrofti)?

Answer:

- Peripheral blood smear
- DEC provocation test
- **USG scrotum** - Filarial dance sign
- **Antibody detection** - non-specific
- **Antigen detection** - specific tests:
  - ELISA - AD12 Ag
  - ELISA - Og4C3 Ag



Microfilaria in blood film
Wuchereria bancrofti

Q18.7: What is the drug of choice for lymphatic filariasis (Wuchereria bancrofti)?

Answer:

- Diethylcarbamazine (DEC)

Q18.8: What are the distinguishing features of Brugia malayi infection compared to Wuchereria bancrofti?

Answer:

- Zoonotic
  - From monkey via mansonia
- Difference from WB
  - The leg below the knee is involved
  - No genital involvement
  - No hydrocele

Q18.9: What are the vector and key features of Onchocerca volvulus infection?

Answer:

- **Vector:** Blackflie s→ "Blackflies cause black thick skin"
- **Skin manifestations:**
  - Dermatitis
  - Leopard skin
  - Onchocercoma
- **Eye involvement:** River blindness
- **Lymph nodes:** Hanging groin



Leopard skin

Q18.10: What is the lab diagnostic test and drug of choice for Onchocerca volvulus infection?

Answer:

- **Lab diagnosis:** Mazotti skin test
- **Drug of choice:** Ivermectin

Q18.11: What are the clinical features and treatment of Loa loa infection?

Answer:

- Mnemonic: **Mr Loa Loa funny song in Calabar**
- Calabar/fugitive smelling
  - Hypersensitivity reaction to adult worms, C/F: Subcutaneous tissues, pruritus, fever
- Treatment: DEC

Q18.12: Name the non-bile-stained eggs.

Answer:

Bile not stained (egg)
• Mnemonic: **NEHA** • **N** - Necator • **E** - Enterobius • **H** - H. Nana • **A** - Ancylostoma

Q18.13: Name the organisms causing autoinfection.

Answer:

Autoinfection
• Mnemonic: **CCHEST** • **C** - Capillaria philippine • **C** - Cryptosporidium • **H** - H.Nana • **E** - Enterobius • **S** - Strongyloides • **T** - T. Solium

Q18.14: Name the eggs that do not float in saturated salt solution (sss).

Answer:

Does not float -SSS
• Mnemonic: **ULTO** • **U** - Unfertilised (Ascaris) • **L** - Larva Strongyloides • **T** - Taenia Egg • **O** - Operculated egg (Trematodes)

Summary of Treatment options for various Parasites

Organism	Treatment
E. Histolytica	• Diarrhoea = Metronidazole + Paromomycin • Liver Abscess = Metronidazole + Chloroquine
B. Coli	Diarrhoea ® Doxycycline
Naegleria Fowleri	Amphotericin B
Acanthamoeba	Combination • Pentamidine • Sulfadiazine • Flucytosine

Giardia Lamblia	Metronidazole
Trichomonas (vaginalis)	Metronidazole (Partner)
T. Cruzi	Benznidazole
T. Brucei Gambiense (west African S.S)	Early: Pentamidine Late: Eflornithine, Nifurtimox
T. Brucei Rhodesiense (East African S.S)	Early: Suramine Late: Melarsoprol
Cryptosporidium	Nitazoxanide
Cyclospora, Isospora	Cotrimoxazole
Toxoplasma	Pyrimethamine + Sulfadiazine
Leishmania (KALA AZAR) PKDL	LAMB Oral miltefosine
Malaria PV/PO PF	Chloroquine (Erythrocyte) + Primaquine (Hypnozoite) ACT + Primaquine (gametocidal)
Babesia AA Severe	Azithromycin + Atovaquone Clindamycin + Quinine
Cestodes Except Echinococcus Except Neurocysticercosis (T. Solium)	Praziquantel Albendazole Albendazole, Steroid, Phenytoin
Trematodes Except Fasciola Hepatica	Praziquantel Triclabendazole
Nematodes Except Strongyloidiasis Onchocerca Filaria, LOA LOA Dracunculus	Albendazole Ivermectin Ivermectin DEC Metronidazole

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9. IMMUNOLOGY

BIG QUESTION 1: What are the important immune cell types (NK cells, T cells, and B cells) and their key markers, functions, and interactions?

Broad Answer: Immune cells such as NK cells, T cells, and B cells play central roles in defense mechanisms. They are identified by specific clusters of differentiation (CD) markers, activated by cytokines, and interact with one another through receptor-ligand binding to regulate immune responses, antibody production, and cytotoxic activity.

Q1.1: What are the important features of Natural Killer (NK) cells?

PYQ: FMGE 2019

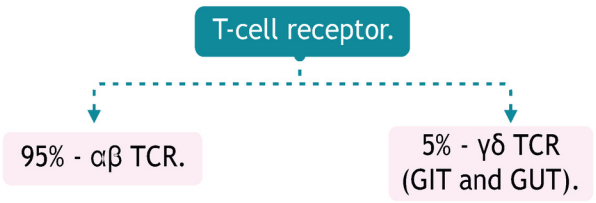
Answer: They recognize and kill virus-infected and cancer cells.

- Inhibitory arm: Recognizes MHC-I (self cells).
- Activating arm: NKG2D receptors detect abnormal cells.
- Cytokines required: IL-2, IL-12, IL-15.
- CD markers: CD16, CD56, Cd94.

Q1.2: What are the different types of T-cell receptors (TCRs) and their distribution?

Answer:

- **αβ TCRs**: Present in 95% of T cells; main type responsible for adaptive immune responses.
- **γδ TCRs**: Present in ~5% of T cells; found mostly in GIT and skin (mucosal surfaces), providing frontline innate-like immune defense.



Q1.3: What are the key markers and subsets of T cells?

Answer:

- CD 1-8, 28
- Signal transduction molecule - Cd3
- Pan T cell marker - Cd3
- Helper T cell - Cd4
- Cytotoxic T cell - CD 8
- CD4: CD8 ratio = 2:1.
  - ↓ in HIV.
  - ↑ in sarcoidosis.

Q1.4: What are the important cytokines released by T-helper cell subsets?

Answer:

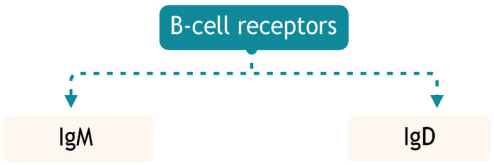
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T Cells		
$CD_4 \rightarrow T_H$ cells		$CD_8 \rightarrow$ T cytotoxic cells (Cell killing)
Th1	• Il2 o TH1 release Il2 o IL2 will stimulate Th1 o NK stimulation • IFN γ - Granuloma formation	• CD95 (Apoptosis) • Perforin Granzyme pathway
TH2	• IL4 - Isotype switch • IL5 - Eosinophil activation • IL13 - Mucus production	
TH17	• IL 17	

Q1.5: What are the main B-cell receptors expressed on naïve B cells?

Answer:

- Naive B cells express IgM and IgD as their surface receptors.
- **IgM**: First antibody to appear during B-cell development and primary immune response.
- **IgD**: Present in smaller amounts; plays a role in B-cell activation and regulation.



Q1.6: What are the markers and functions of B cells?

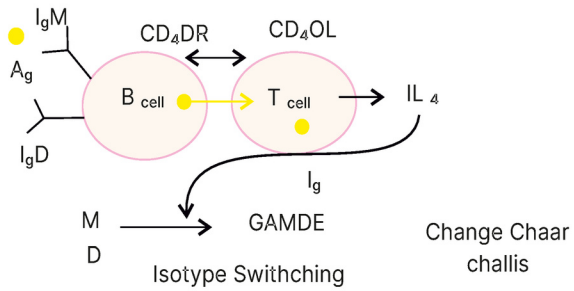
Answer:

- CD 10, 19, 20, 21, 22, 23, 40, 79a, 79b
- Pan B cell marker - CD 19
- Signal transduction molecule - CD79 a and b
- EBV entry - CD 21.

Q1.7: How do B cells and T cells interact during an immune response?

PYQ: AIIMS 2020,2023

Answer:



- B cells express the CD40 receptor.
- T-helper cells express CD40 ligand.
- CD40 receptor-CD40 ligand interaction leads to IL-4 release by T cells.
- IL-4 promotes isotype switching from IgM/IgD →All other antibodies

BIG QUESTION 2: How do Antigen Presenting Cells (APCs) and Major Histocompatibility Complex (MHC) contribute to immune activation?

Broad Answer: Antigen-presenting cells (APCs) process and present antigens through MHC molecules to T cells, leading to immune activation. MHC Class I presents endogenous antigens to CD8+ cytotoxic T cells, while MHC Class II presents exogenous antigens to CD4+ helper T cells.

DETAILED QUESTIONS

Q2.1: What are Antigen-Presenting Cells (APCs)?

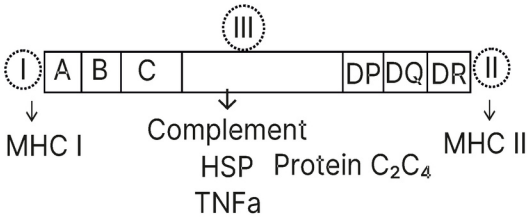
Answer: Antigen-presenting cells (APC) are the first cells that pick up the antigen

- **Professional APCs:** Dendritic cells, B cells, Macrophages
- **Non-professional APCs:** Thymic epithelial cells, Endothelial cells, Fibroblasts
- **Function:** Pick up antigens and present them to T cells via MHC molecules.

Q2.2: Where is the Major Histocompatibility Complex (MHC) located and what are its components?

Answer: PYQ: FMGE 2020

- Location: Short arm of chromosome 6 (6p)
- Genes: HLA A, B, C (MHC I); HLA DP, DQ, DR (MHC II)

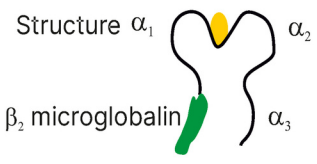
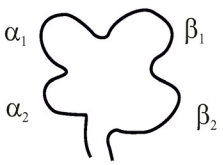


- Additional: Complement proteins (C2, C4), Heat shock proteins, TNF-α

HLA gene part I - MHC I	HLA gene part II - MHC II	HLA part III
• HLA A • HLA B • HLA C	• HLA DP • HLA DQ • HLA DR	• Complement proteins C2, C4. • Heat shock proteins (HSP). • TNF α

Q2.3: What are the structural and functional differences between MHC Class I and MHC Class II?

Answer:

Characteristic	MHC I	MHC II
Structure		
	• α1 • α2 • α3 • β2-microglobulin	• α1 • α2 • β1 • β2
Antigen binding cleft	α1-α2 junction	α1-β1 junction

Present on cells	• All nucleated cells. • Platelets. • **Red blood cells and sperm cells lack MHC I.**	Antigen-presenting cells.
Present to cells	**CD8 T cells.**	**CD4 T cells.**

BIG QUESTION 3: What are the types of Hypersensitivity Reactions and give clinical examples?

Broad Answer: Hypersensitivity reactions are exaggerated immune responses that cause tissue injury. They are classified into four main types (Gell and Coombs classification):

Type I (Anaphylactic / Immediate)	IgE-mediated, mast cell degranulation (e.g., anaphylaxis, asthma)
Type II (Cytotoxic):	IgG/IgM-mediated antibodies act against cell-surface antigens (e.g., transfusion reaction, Goodpasture syndrome).
Type III (Immune Complex)	Deposition of antigen-antibody complexes causes inflammation (e.g., SLE, serum sickness).
Type IV (Delayed type / Cell-mediated):	T-cell mediated, takes 48-72 hrs (e.g., TB Mantoux test, contact dermatitis).
Some classify receptor antibody-mediated as Type V	E.g., Myasthenia gravis, Graves disease

DETAILED QUESTIONS

Q3.1: What are examples of Type I Hypersensitivity?

Answer: (Mnemonic - ABCD)

- Allergies (dermatitis, rhinitis, conjunctivitis)
- Atopy - genetic predisposition (chromosome 5)
- Bronchial asthma
- Casoni test (Echinococcus granulosus)
- Drugs (penicillin, sulfa)
- Positive Prausnitz-Küstner (PK) reaction
- Theobald-Smith phenomenon

Q3.2: What are examples of Type II Hypersensitivity?

Answer: (Mnemonic - My Blood Group Is Rh Positive)

- Myasthenia gravis
- Blood transfusion reaction
- Goodpasture syndrome
- Graves disease
- Immune cytopenias → Immune hemolytic anemia, Immune thrombocytopenic purpura
- Rh incompatibility
- Rheumatic heart disease
- Pemphigus vulgaris
- Pernicious anemia

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Q3.3: What are examples of Type III Hypersensitivity?

Answer: (Mnemonic - SHARP)

- Systemic lupus erythematosus (SLE) → **Type II and III hypersensitivity**
- Serum sickness
- Schick test (Corynebacterium diphtheriae)
- Henoch-Schönlein purpura (IgA vasculitis in kids)
- Arthus reaction (localized immune complex disease)
- Raji assay
- Reactive arthritis
- Post-streptococcal GN (cola-colored urine)
- Polyarteritis nodosa (PAN)

Q3.4: What are examples of Type IV Hypersensitivity?

Answer:

- Granulomatous diseases: TB, Sarcoidosis
- Skin tests: Mantoux (TB), Lepromin (leprosy)
- Inflammatory bowel disease → Crohn's disease
- Multiple sclerosis
- Contact dermatitis: Poison ivy (worldwide), Nickel jewelry/detergents (India)

Q3.5: A 22-year-old man develops sudden breathlessness, urticaria, and hypotension after a bee sting. Which hypersensitivity reaction is this?

Answer:

- Type I (Anaphylactic) hypersensitivity
- Mediated by IgE, mast cells, and histamine release
- Example of immediate reaction

Q3.6: A child develops cola-colored urine after a throat infection due to Streptococcus. Which hypersensitivity reaction is this?

Answer:

- Type III hypersensitivity (immune complex-mediated)
- Example: Post-streptococcal glomerulonephritis

Q3.7: A patient develops hemolysis after receiving a mismatched blood transfusion. Which hypersensitivity reaction is this?

Answer:

- Type II hypersensitivity (Cytotoxic)
- Mediated by IgG/IgM antibodies against RBC antigens

Q3.8: A patient develops induration at the site of a Mantoux test after 48 hours. Which hypersensitivity reaction is this?

Answer:

- Type IV hypersensitivity (Delayed type)
- Mediated by Th1 CD4+ T cells releasing IFN-γ

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Q3.9: Which diseases involve mixed types of hypersensitivity reactions?

Answer:

Rheumatoid arthritis :	Type III and Type IV
Hypersensitivity pneumonitis :	Type III and Type IV
Systemic lupus erythematosus (SLE) :	Type II and Type III

Q3.10: What are the types of hypersensitivity involved in transplant rejection?

Answer:

Hyperacute rejection	Type II (antibody-mediated)
Acute rejection	Type II and Type IV (antibody + T-cell mediated)
Chronic rejection	Type IV (T-cell mediated with fibrosis)

BIG QUESTION 4: What are the key autoimmune disorders, immunofluorescence patterns, and disease-specific antibodies?

Broad Answer: The main autoimmune disorders are SLE, Sjögren's syndrome, and Scleroderma. Diagnosis relies on ANA detection using immunofluorescence patterns and identification of disease-specific antibodies. Different antibodies help determine sensitivity, specificity, and prognosis in each condition.

DETAILED QUESTIONS

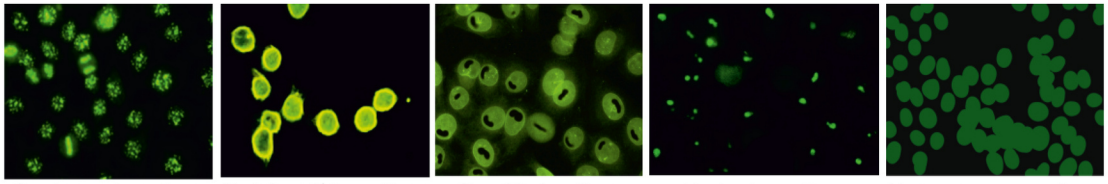
Q4.1: What are the common autoimmune disorder?

Answer: Systemic Lupus Erythematosus (SLE), Sjögren's Syndrome, and Scleroderma.

Q4.2: How is ANA (antinuclear antibody) measured, and what are the immunofluorescence patterns?

Answer: Measured by immunofluorescence. PYQ: AIIMS 2023

Pattern	Antibody against
Homogeneous	anti-chromatin, histone, nuclear
Peripheral/Rim	anti-ds DNA
Nucleolar	antibody against RNA
Speckled (most common, non-specific)	anti-Smith - SLE anti-Ro, anti-La - Sjogren's syndrome
Centromeric	anti-centromeric antibody (limited scleroderma)



Centromeric pattern | Peripheral/rim pattern | Speckled pattern | Nucleolar pattern | Homogeneous pattern

Q4.3: Which antibodies are important in SLE?

PYQ: FMGE 2021

Answer:

Most sensitive	ANA (antinuclear antibody)
Most specific	ASA (anti-Smith antibody)
Both sensitive and specific	Anti-ds DNA antibody
Neonatal lupus	Anti-Ro antibody.
SLE with psychosis	Anti-ribosomal P antibody.
Drug-induced lupus	Anti-histone antibody.

Q4.4: Which antibodies are important in Sjögren's syndrome?

Answer:

Most sensitive	Anti-SS-A (Anti-Ro)
Most specific	Anti-SS-B (Anti-La)

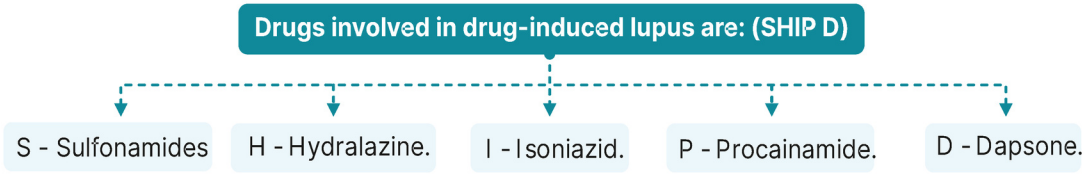
Q4.5: Which antibodies are important in Scleroderma?

Answer:

Limited scleroderma	Anti-centromeric antibody.
Diffuse scleroderma	Anti-topoisomerase antibody (Anti-Scl 70).

Q4.6: Which drugs are involved in drug-induced lupus?

Answer:



BIG QUESTION 5: What are the major primary immunodeficiency disorders, their genetic defects, and clinical features?

Broad Answer: Primary immunodeficiency disorders are caused by genetic mutations affecting T cells, B cells, or both. They present with recurrent infections, autoimmunity, or developmental abnormalities. Common disorders include Severe Combined Immunodeficiency (SCID), Bruton's agammaglobulinemia, DiGeorge syndrome, Hyper-IgM syndrome, Hyper-IgE syndrome, IgA deficiency, Wiskott-Aldrich syndrome, and Bare Lymphocyte Syndrome.

DETAILED QUESTIONS

Q5.1: What are the causes and features of Severe Combined Immunodeficiency (SCID)?

Answer:

Defects	Clinical features
X-linked recessive (most common) • γ-subunit of cytokine receptor defect **Autosomal recessive** • ADA deficiency (most common in AR) • JAK3 defect • RAG1/2 defect	Child with morbilliform rash

Q5.2: What is Bruton's agammaglobulinemia?

Answer:

Defects	Clinical features
BTK gene mutation (X-linked)	Boys affected, B-cell defect, ↓ IgG levels, defective opsonin.

Q5.3: What is the underlying defect in Bare Lymphocyte Syndrome?

Answer: MHC II missing

Q5.4: What are the features of DiGeorge Syndrome?

Answer:

Defects	Clinical features
Deletion of chromosome 22q	• Thymus not formed • T-cell defect • Parathyroid not formed • Hypocalcemia • Cleft lip • Cleft palate • Abnormal facies • Tetralogy of Fallot

Q5.5: What is Hyper-IgM Syndrome?

Answer:

Defects	Clinical features
• CD40 receptor defect • CD40 ligand defect	Pneumocystis jirovecii pneumonia.

Q5.6: What is Hyper-IgE Syndrome (Job Syndrome)?

Answer:

Defects	Clinical features
STAT3 gene defect	Clinical Mnemonic **(FATE):** • **F** → Coarse **F**acies • **A** → Cold **A**bscess (Staphylococcus) • **T** → Retained Primary **T**eeth • **E** → ↑ Ig**E** and **E**czema

Q5.7: What is Isolated IgA Deficiency?

Answer:

Defects	Clinical features
IgA deficiency	Washed red blood cells are given in transfusion

Q5.8: What is Wiskott-Aldrich Syndrome?

Answer:

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Defects	Clinical features
WASP gene	• Bleeding (small platelets) • Infections • Eczema • Decreased IgM levels • Increased IgA and IgE levels.

Q5.9: What are the most common genetic patterns in SCID?

Answer: Overall, the most common defect in SCID → X-linked recessive pattern

- Most common defect in autosomal recessive SCID → ADA deficiency.

BIG QUESTION 6: What are the types of grafts, mechanisms of transplant rejection, and features of graft-versus-host disease (GVHD)?

Broad Answer: Transplant immunology studies grafts, rejection mechanisms, and GVHD.

- Types of grafts: Autograft, Isograft, Allograft, Xenograft.
- Transplant rejection: Hyperacute (Type II HS), Acute (Type II & IV HS), Chronic (Type IV HS).
- GVHD: Occurs when grafted immune cells attack an immunocompromised host, with acute and chronic forms.

DETAILED QUESTIONS

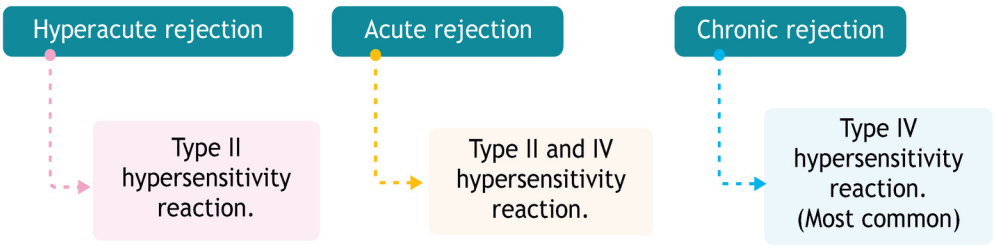
Q6.1: What are the types of grafts?

Answer:

Type of Graft	Description
Autograft	From the same individual.
Isograft	Between identical twins.
Allograft	Between the same species but genetically different.
Xenograft	Between different species.

Q6.2: What are the types of transplant rejection and their hypersensitivity mechanisms?

Answer:

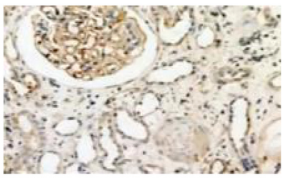


Q6.3: What are the timelines and mechanisms of hyperacute, acute, and chronic rejection?

Answer: PYQ: FMGE 2018,2022

Hyperacute rejection	Acute rejection	Chronic rejection
< 48 hours.	Days to weeks.	Weeks to months.
Preformed antibodies. o Multiparous ladies. o Multiple blood transfusions.	Acute humoral rejection (HS2) o **Marker: C4d**	Cellular reaction.

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	 Acute cellular rejection (HS4)	
Fibrinoid necrosis - Vessels. Coagulative necrosis - renal.	• Acute humoral rejection. o Rejection Vasculitis. • Acute cellular rejection o Tubulitis. o Endotheliitis.	• Glomerular basement membrane duplication. • Obliteration/ sclerosis of blood vessels. • Tubular atrophy. • Interstitial fibrosis.

Q6.4: What are the main pathological features of acute rejection?

Answer:

Acute humoral	Rejection vasculitis, C4d deposition.
Acute cellular	Tubulitis, endotheliitis, necrosis of renal tissue.

Q6.5: What are the features of chronic rejection?

Answer:

- Glomerular basement membrane duplication.
- Obliteration/sclerosis of blood vessels.
- Tubular atrophy.
- Interstitial fibrosis.

Q6.6: What is Graft-versus-Host Disease (GVHD)?

Answer: Graft is immunocompetent; recipient is immunocompromised

Q6.7: What are the features of acute and chronic GVHD? PYQ: AIIMS 2021

Answer:

	Acute GVHD	Chronic GVHD
Duration	< 100 days	> 100 days
Skin	Rash.	
Intestine	Diarrhea.	
Liver	Jaundice.	

BIG QUESTION 7: What are the types, organ involvement, detection methods, and gross features of Amyloidosis?

Broad Answer: Amyloidosis is caused by the deposition of abnormal proteins in ß-pleated sheet form. It can occur in chronic inflammation, malignancies, hereditary syndromes, metabolic diseases, and neurodegenerative disorders. Amyloid deposition affects multiple organs (kidney, heart, liver, spleen, skin, joints, vessels), producing waxy appearance and organomegaly. Diagnosis is confirmed by Congo red staining with apple-green birefringence.

DETAILED QUESTIONS

Q7.1: What are the main types of amyloid proteins and associated conditions?

Answer:

Disease	Amyloid
Chronic inflammation Except for chronic bronchitis	AA
Cancers	AA
Familial Mediterranean fever	AA
Medullary carcinoma thyroid	Acal (calcitonin)
Systemic senile amyloidosis	ATTR (Increased quantity)
Familial amyloidotic polyneuropathy	ATTR (Mutant)
Alzheimer's disease	Aß
Hemodialysis PYQ: AIIMS 2023	Aß2
Diabetes mellitus	IAPP
Multiple myeloma	AL

Note: AL - Amyloid light chain, AA - Amyloid-associated proteins, ACal - Amyloid calcitonin, Aß - Amyloid ß plaques, Aß2 - Amyloid ß2 microglobulin, ATTR - Amyloid transthyretin.

Q7.2: Which organs are commonly affected in amyloidosis and how?

Answer:

Organ	Site
Kidney • **Most common organs are affected.**	Mesangium.
Heart • **The most common organ is affected in the elderly.**	Subendocardial.
Liver	Space of Disse.
Spleen red pulp	Lardaceous spleen.
Spleen white pulp	Sago spleen.
Skin	Pinch purpura.
GIT	Organomegaly.
Joints	Carpal tunnel syndrome at the wrist joint.
Blood vessels	Subendothelial.

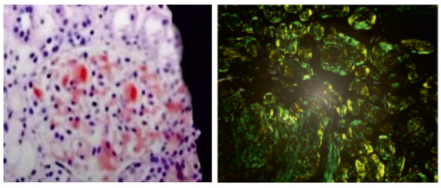
Q7.3: What are the gross findings in amyloidosis?

Answer:

- All organs → Waxy appearance.
- Diffuse organomegaly (except the kidney → shrinks in late stages).

Q7.4: What are the staining methods used to detect amyloid?

Answer:

Gross stain	Lugol's iodine. Mahogany brown color.
Microscopic stains	
Congo red PYQ: AIIMS 2019	Apple green birefringence on **polarizing** microscopy. 
Thioflavin T	UV light.
Miscellaneous stains	Methyl violet, Crystal violet, PAS

Q7.5: What are the special investigations for amyloidosis?

Answer:

- Electron microscopy: 7.5-10 nm fibrils.
- X-ray crystallography: ß-pleated sheets.
- Sample collection: Abdominal fat aspiration >> Rectal biopsy.
- Extent: Scintigraphy.

BIG QUESTION 8: What are the properties of antigens and antibodies, including types, structure, and immunoglobulins?

Broad Answer: Antigens are substances that induce or bind to immune responses, while antibodies are immunoglobulins with specific structural features that neutralize antigens. Concepts include antigenicity, immunogenicity, haptens, heterophile antigens, and superantigens. Antibodies have heavy and light chains, with different immunoglobulin classes (IgG, IgA, IgM, IgD, IgE) showing unique functions, concentrations, and roles in immunity.

DETAILED QUESTIONS

Q8.1: What is the difference between immunogenicity and antigenicity?

Answer:

- Immunogenicity → Ability to induce an immune response.
- Antigenicity → Ability to bind an antibody.
- All immunogenic substances are antigenic, but not all antigenic substances are immunogenic.

Q8.2: What are haptens (incomplete antigens)?

Answer: **Hapten/Pro-Antigen/Incomplete Antigen**

- Antigenicity will be there, but it will not create an immune response known as Hapten (incomplete protein)
- Become immunogenic when combined with a protein carrier → Hapten + Protein Carrier = Complete Antigen.

Q8.3: What are heterophile antigens? Give examples.

Answer: Antigen is sharing epitopes and thus, antibody cross reacts. It is seen in:

- Weil-Felix Test → Rickettsia
- Paul-Bunnell Test → EBV

Q8.4: What are superantigens?

Answer:

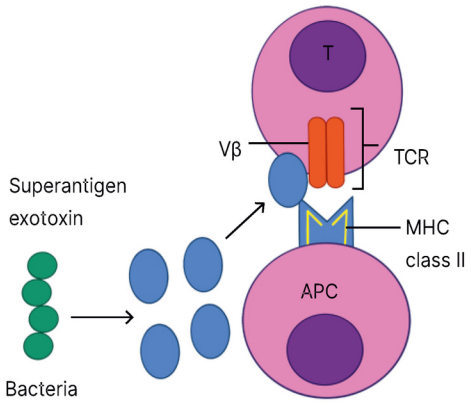
Induces > 20% T lymphocytes activation

↓

Leads to massive lymphokine release

↓

History of toxic shock syndrome: E.g. Staphylococcus Aureus (tampons usage)

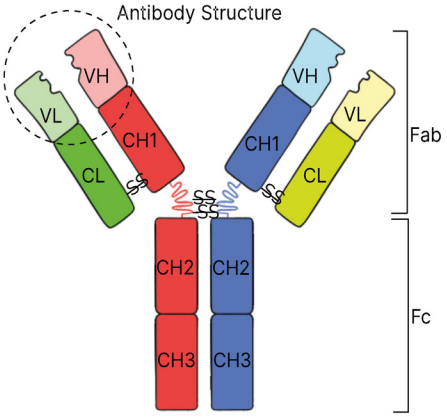


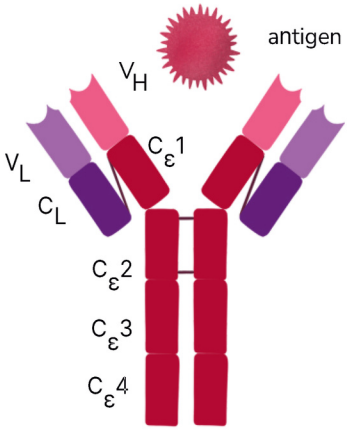
- **Examples:**
  - **Bacteria:** Staphylococcus aureus (TSST), Streptococcal toxin (SPE-A, SPE-C), Yersinia enterocolitica, Y. pseudotuberculosis, M. tuberculosis
  - **Viruses:** EBV, CMV, Rabies
  - **Fungus:** Malassezia furfur

Q8.5: What is the structure of an antibody?

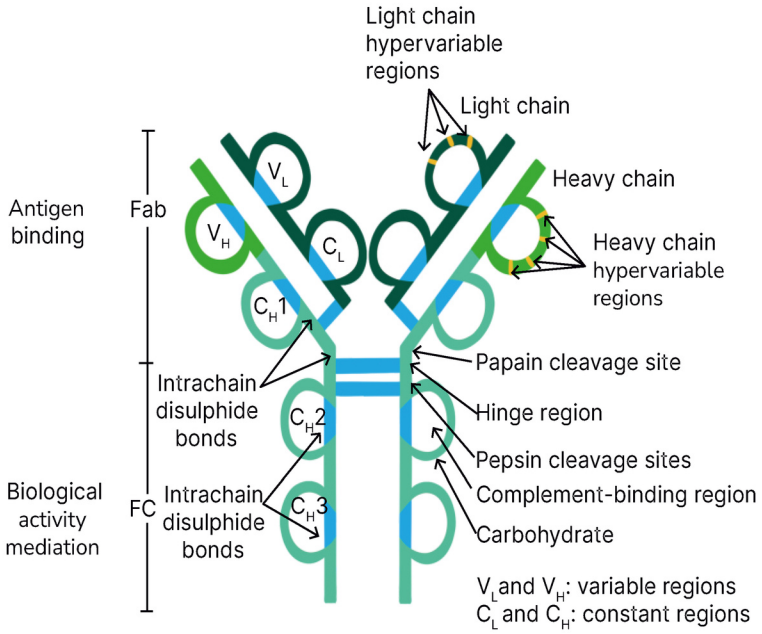
Answer:

- 2 Heavy chains (50,000 D) + 2 Light chains (25,000 D), linked by disulfide bonds.





- Light chain → 1 variable + 1 constant region.
- Heavy chain → 1 variable + 3 or 4 constant regions.
- Antigen binding site → Hypervariable/Complementarity determining region (CDR).



Q8.6: Arrange immunoglobulins in order of concentration in blood.

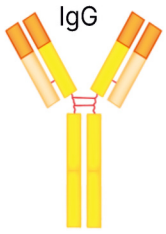
PYQ: FMGE 2022

Answer: IgG > IgA > IgM > IgD > IgE

Q8.7: What are the key features of IgG?

Answer

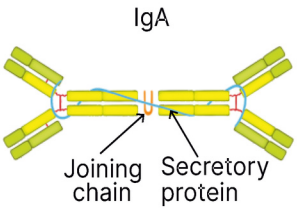
- Crosses placenta
- Highest concentration in blood
- Valency: 2
- Seen in chronic inflammation
- Activates the classical complement pathway
- G1 & G3 → best opsonins
- G2 → least chance of placental transfer
- G4 → associated with fibrotic diseases



Q8.8: What are the key features of IgA?

Answer:

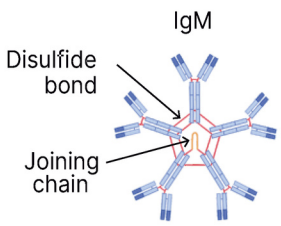
- Monomeric in serum; dimeric in mucosa/secretions
- Major mucosal defense antibody



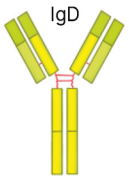
Q8.9: What are the key features of IgM?

Answer:

- Pentameric (Valency: Ideally 10, practically 5-6)
- Maximum antigen binding sites
- Highest molecular weight
- 80% intravascular
- First antibody in acute inflammation
- Activates classical & alternate complement pathways



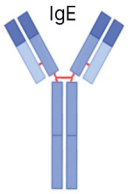
Q8.10: What are the key features of IgD?



Answer:

- Can activate the alternate complement system.
- Functions as B-cell receptor

Q8.11: What are the key features of IgE?



Answer:

- The least concentration in the blood
- Homocytotropic/Reaginic antibody
- Increase in allergy & parasitic infections

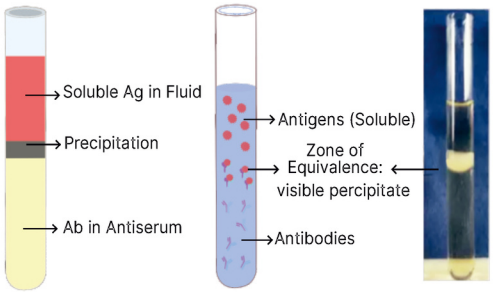
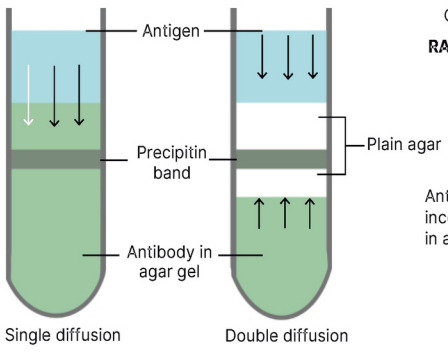
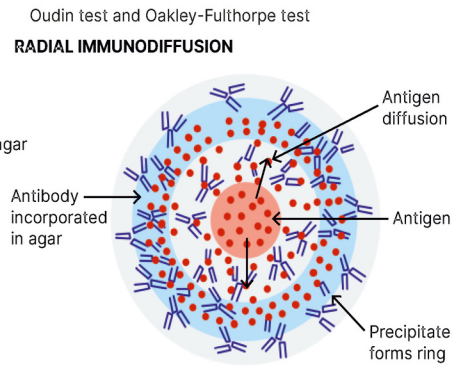
BIG QUESTION 9: What are the major types of Antigen-Antibody reactions and their diagnostic applications?

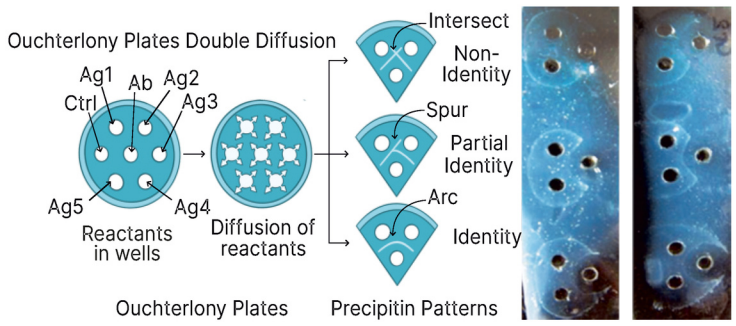
Broad Answer: Antigen-antibody reactions include precipitation, agglutination, ELISA, immunofluorescence, and rapid tests. They are used in the lab diagnosis of infectious diseases, autoimmune diseases, and blood grouping. Each reaction type has characteristic principles and clinical examples.

DETAILED QUESTIONS

Q9.1: What are precipitation reactions?

Answer: Antigen-antibody combined in liquid or gel → visible precipitate.

Medium	Description
In liquid medium	• Ring test: Streptococcal Lancefield grouping, Ascoli test (Anthrax) • Flocculation: Khan test (tube), VDRL (slide) 
In gel (immunodiffusion)	• Single diffusion (Oudin test) → only antigen moves • Double diffusion (Ouchterlony test) → both antigen & antibody move • One dimension: reaction occurs in test tube • Two dimension: reaction in slide  

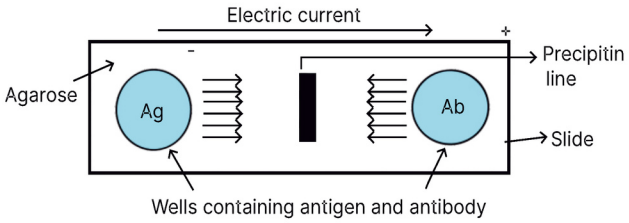


Ouchterlony Double Diffusion test

Q9.2: What is counterimmunoelectrophoresis (CIEP)?

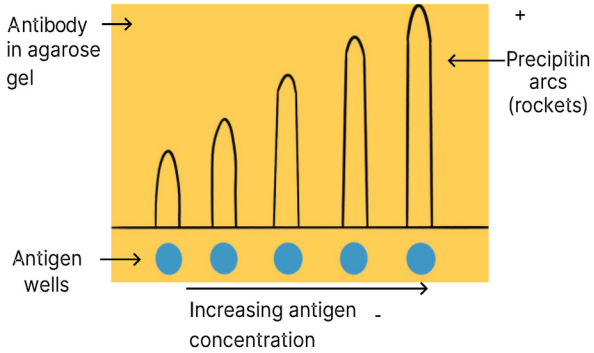
Answer:

- Faster method where antigen and antibody move towards each other in an electric field.
- Previously used for cryptococcal antigen detection (now replaced by latex agglutination).



Q9.3: What is rocket electrophoresis used for?

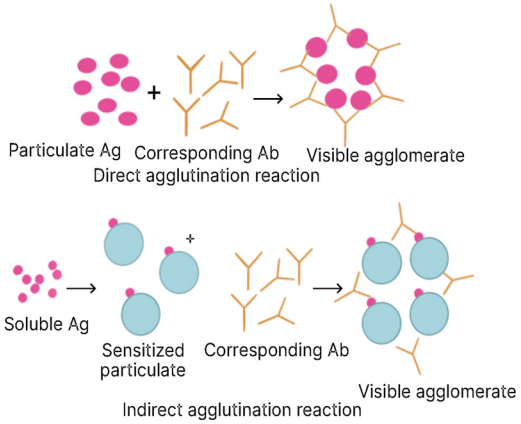
Answer: A quantitative method for antigen estimation.



Q9.4: What are agglutination reactions and types?

Answer: Better than precipitation.

- Direct agglutination: Antigen is naturally particulate (e.g., RBCs, bacteria).
- Indirect agglutination: Soluble antigen is coated on carrier particles (e.g., latex).

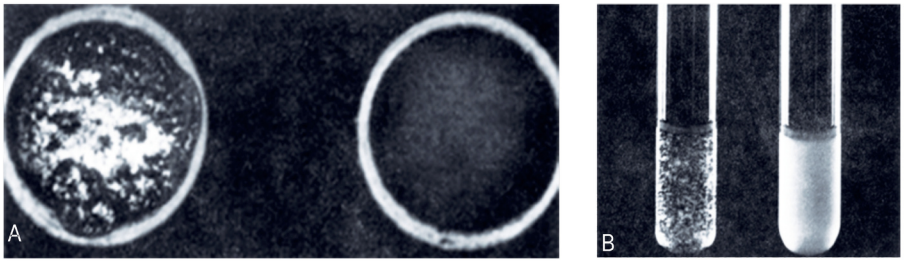


YOURWISH

Q9.5: What are examples of direct agglutination tests?

Answer:

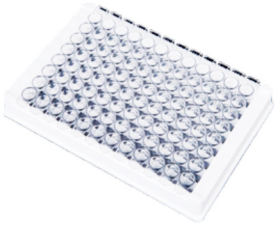
- **Slide method**: Blood grouping.
- **Tube method**: WIDAL (typhoid), SAT, CAT, Weil Felix (Rickettsia), Paul Bunnell (EBV), COOMB's test.
- ***Mnemonic:***
  - **CAT - MY:** Mycoplasma → Cold Agglutination Test
  - **SAT - Bi:** Brucella → Standard Agglutination Test
  - **MAT - Lii:** Leptospira → Microscopic Agglutination Test



Q9.6: What is ELISA and its principle?

Answer:

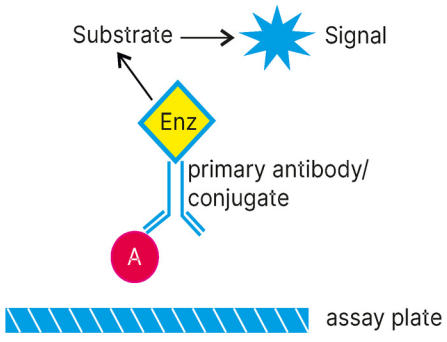
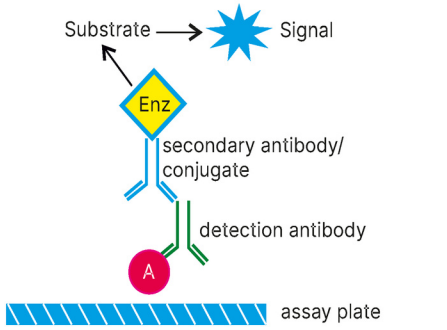
- Enzyme-Linked Immunosorbent Assay → Antigen-antibody detected with an enzyme-conjugated antibody + substrate.
- Has a total of 96 wells.
- Enzyme: Horseradish Peroxidase (HRP)
- Substrate: H_2O_2
- Chromogen: Tetramethyl Benzidine (TMB)



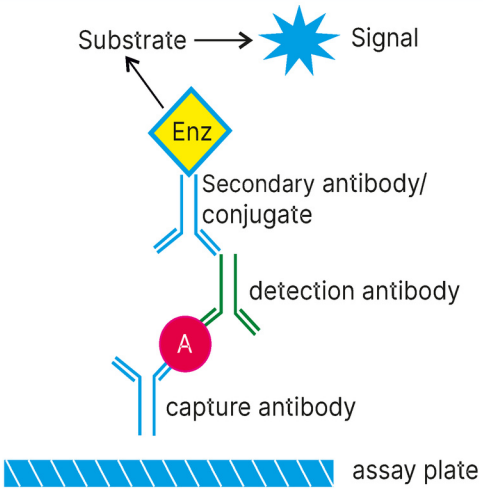
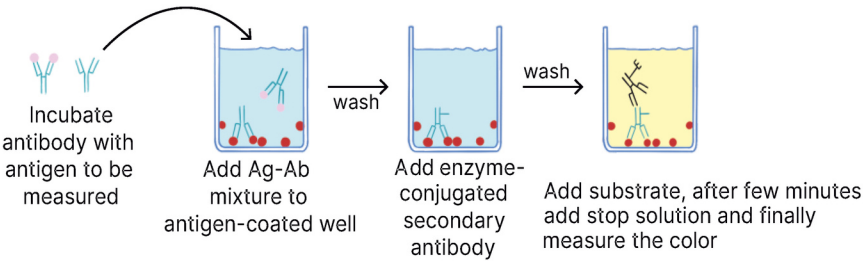
ELISA plate

Q9.7: What are the types of ELISA?

Answer:

Type	Description	Illustration
Direct ELISA	• Antigen detection • Antigen (patient) combined with the antibody (antibody combined with horseraddish peroxidase) • Then it will break a substrate (H_2O_2) → Detected by adding a chromogen (benzidine) • Antigen is present → Color will be detected in the end.	
Indirect ELISA	• Detects antibody • Sample (antibody) and antigen is added then same process is followed.	

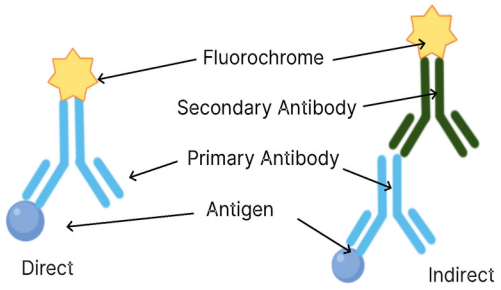
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Sandwich ELISA	• Variety of direct ELISA • For antigen detection	
Competitive ELISA:	• For antigen detection • Incubate the antibody with the antigen to be measured • Add the antigen-antibody mixture to the antigen-coated well • Add enzyme-conjugated secondary antibodies • Add substrate after a few minutes, add stop solution, and finally measure the color. Competitive ELISA to detect Ag (Free Testosterone) 	

Q9.8: What is immunofluorescence?

Answer:

- Direct IF: Detects antigen using fluorescent-labeled antibody.
- Indirect IF: Detects antigen or antibody using a secondary fluorescent-labeled antibody.
- Dye used: FITC (Fluoro-isothiocyanate).



Q9.9: What is the principle of rapid card tests?

Answer:

- Principle = Immunochromatography (ICT)
- White color membrane made up of Nitrocellulose membrane

