5. Toxins produced:
   a) **Tetanolysin**: $O_2$- & heat-labile
   b) **Tetanospasmin**: $O_2$-stable but heat-labile neurotoxin (essential pathogenic product)
   c) A 3rd toxin: non-spasmogenic, peripherally active neurotoxin

6. Pathogenesis:

   Wound contamination with *C. tetani* spores
   
   **Germination & toxin production** take place only in wounds with low redox potential
   
   Released **toxin** binds to **peripheral MN terminal & enters axon**
   
   Transports to **neurofilament in CNS via retrograde intraneuronal transport**
   
   **Migrates across synapses to presynaptic terminals**
   
   Binds to gangliocyte receptors & blocks inhibitory NT (GABA) release from vesicles via **tetanoplasmin*** (a Zn metalloprotease)
   
   Abolition of spinal inhibition causes **uncontrolled spreading** of impulses initiated anywhere in CNS
   
   **Muscle rigidity & spasm** (due to simultaneous contraction of agonists & antagonists in absence of reciprocal inhibition)

*Involves cleavage of synaptobrevin (protein essential in proper functioning of synaptic vesicle release apparatus)
17. Lab diagnosis:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimens</td>
<td>Uneaten food, serum</td>
</tr>
<tr>
<td>Gram staining</td>
<td>*Gram (+) bacilli</td>
</tr>
<tr>
<td></td>
<td>*Subterminal, oval bulging spores</td>
</tr>
<tr>
<td></td>
<td>*Motile</td>
</tr>
<tr>
<td>Culture</td>
<td>*Strict anerobe</td>
</tr>
<tr>
<td></td>
<td>*Optimum temperature: 35°C</td>
</tr>
<tr>
<td></td>
<td>*Spores produced when grown in alkaline glucose gelatin medium (at 20–25°C)</td>
</tr>
<tr>
<td>Mice inoculation</td>
<td>Death (unless protected by antitoxin)</td>
</tr>
</tbody>
</table>

18. Botulism:

1. Types: food-borne, infant, wound
2. Bioterrorism-related botulism is the potential result of intentional dispersal (as aerosol/contaminant in ingested material) of the (most potent bacterial) toxin
3. Infant botulism:
   a) Microbe grows in gut & produces toxin
   b) Source: ingestion of contaminated honey
   c) Infant develops weakness/paralysis & may need respiratory support, but usually recovers spontaneously (by contrast, it is usually fatal in adults)

*Differential diagnosis (involves ruling out of...)*
1. Poliovirus:
   - Family: picornaviridae
   - Group: enterovirus
   - Non-enveloped
   - Icosahedral nucleocapsid
   - Acid-stable
   - +ve sense ssRNA
   - Natural infections occur only in humans
   - Antigenic types (PV1, 2, 3)

2. Transmission & epidemiology:
   a) Transmitted via fecal-oral route
   b) Distribution: Pakistan, Afghanistan, Nigeria

3. Pathogenesis proper:
   - Incubation period: 10 – 14 days
   - Replicates in oropharynx & GIT (may be transported to lymphoid tissue)
   - Viremia takes it to CNS
   - LMN lesion
   - (Anterior horn) cell death
   - Replicates in MNs in anterior horn (of spinal cord)

*Encephalitis primarily involves brainstem*
6. Pathogenesis:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modes of transmission</td>
<td>*Contact with salvia from infected animals (i.e. bites, scratches, licks on broken skin &amp; mucus membrane)</td>
</tr>
<tr>
<td></td>
<td>*Airborne (aerosol) in bat rabies</td>
</tr>
<tr>
<td></td>
<td>*Iatrogenic (corneal transplants)</td>
</tr>
</tbody>
</table>

Pathogenesis Proper

Bite/other modes

Incubation period: 1 – 3 months

Attaches to ACh receptor

Spreads to nerves in CNS (via retrograde axonal transport)

Reaches peripheral nerves at NMJ

Multiply in muscle/ connective tissue

Multiplication in brain (encephalitis)

Spreads thru nerves to other organs

#e.g. salivary glands, muscles, retina, cornea, adrenals, skin

*NO viremia* is observed

7. Clinical rabies:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prodromal phase (2 – 4 days)</td>
<td>*Malaise, fever, headache *Discomfort at site of bite</td>
</tr>
<tr>
<td>Clinical forms</td>
<td>*Furious rabies (encephalitic form, leads to seizures)  *Dumb rabies (paralytic form)</td>
</tr>
</tbody>
</table>
8. Lab diagnosis:

1. Done ante-mortem
2. Involves rabies Ag & NA detection
3. Fluorescent Ig technique (FAT)/ DFA on corneal smear:
   a) FAT on skin biopsy
   b) RT-PCR with saliva, CSF
   c) Ig detection in serum, CSF
4. Virus isolation (in adult/ suckling mice)
5. Cell culture (in murine neuroblastoma/ BHK 21 cells)

9. Negri bodies:
   a) Present in brain tissue (detected post-mortem)
   b) Eosinophilic intra-cytoplasmic bodies with basophilic inner granules
   c) Seen in about 60 – 70 % cases only
   d) Simple, rapid & specific marker (of rabies)
   e) Observed via direct impression smears from brain/ after-sections, or Seller’s staining on fresh brain

10. Vaccines:

<table>
<thead>
<tr>
<th>Clinical presentations</th>
<th>Encephalitic form (80%)</th>
<th>Paralytic rabies (20%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hydro-/ aero-/ photo-phobia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Respiratory arrest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Seizures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Coma &amp; death</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ascending paralysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bladder involvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cardio-respiratory arrest (eventually)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Coma &amp; death</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER EE: PRIONS

1. Features & their differences from conventional infectious agents:
   
   1. Have **proteinaceous infectious particles** but NO DNA/ RNA
   
   2. Composed of **single glycoprotein**
   
   3. **Extremely resistant** to heat, disinfectants & irradiation
   
   4. **Inactivated** by hypochlorite, NaOH and autoclaving
   
   5. **Slow replication** rate (incubation period up to 35 years)
   
   6. Cannot be **cultured** → elicit no immune responses (as there is no Ag presentation)
   
   7. Comparison between PrP<sup>C</sup> & PrP<sup>SC</sup>

<table>
<thead>
<tr>
<th></th>
<th>PrP&lt;sup&gt;C&lt;/sup&gt;</th>
<th>PrP&lt;sup&gt;SC&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td>Linear</td>
<td>Globular</td>
</tr>
<tr>
<td>Susceptibility to proteases</td>
<td>Susceptible</td>
<td>Resistant</td>
</tr>
<tr>
<td>Predominant 2° structure</td>
<td>α-helices</td>
<td>β-pleated sheets</td>
</tr>
<tr>
<td>Others</td>
<td>May function in signal transduction</td>
<td>Aggregates to form filaments</td>
</tr>
</tbody>
</table>

8. For a prion (PrP<sup>SC</sup>) to infect a host, the host must have a **recognizable cellular form** (PrP<sup>C</sup>) of that prion

9. The **closer** the phylogenetic relationship between donor host & the recipient, the greater the chance for infection & the more rapidly symptoms occur

10. **Transmission** is thru ingestion, blood transfusion, iatrogenic
2. E.g. prion disorders: [Refer Part ED 02, #3]

3. CJD & kuru:

<table>
<thead>
<tr>
<th></th>
<th>CJD</th>
<th>Kuru</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transmission</strong></td>
<td>iatrogenic (e.g. corneal transplants &amp; growth hormone injections)</td>
<td>Ingestion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Thru cuts (wounds)</td>
</tr>
<tr>
<td><strong>Clinical features</strong></td>
<td>*Dementia</td>
<td>*Progressive tremors</td>
</tr>
<tr>
<td></td>
<td>*Myoclonic seizures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Ataxia, aphasia, visual loss, hemiparesis</td>
<td>*Ataxia w/o dementia</td>
</tr>
</tbody>
</table>
22. Treatment: penicillin G

23. Prophylaxis:
   a) Rifampicin, ciprofloxacin
   b) Vaccines for capsular polysaccharides (A, C, Y, W-135) for soldiers/travellers

SUB-SUB-PART GA 01 (B 3): HEMOPHILUS INFLUENZAE

24. Transmission: airborne (throat carriage)

25. Predisposing factor: children (6 months to 5 years) – *H. influenzae* *b* present in respiratory tract of infants & young children

26. Virulence factors:
   a) **Capsule**: PRP (polyribosyl ribitol (P) ) Ag induces IgG, M & A (which are bactericidal, opsonic & protective)
   b) **Pili**
   c) **IgA protease**
   d) **Endotoxin**
   e) **Outer membrane proteins**

*N. meningitidis* has 6 serotypes (a – f), but invasions like meningitis is caused by type “b” (hence, the vaccine for it is Hib)

27. Pathogenesis
<table>
<thead>
<tr>
<th>Gram staining</th>
<th>*Gram (-) coccobaccilli</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*Pleomorphic:</td>
</tr>
<tr>
<td></td>
<td>a) <strong>Coccobacilli</strong> in sputum</td>
</tr>
<tr>
<td></td>
<td>b) <strong>Long, bacillary, filamentous</strong> in CSF with meningitis</td>
</tr>
<tr>
<td>CSF changes</td>
<td>*Turbid</td>
</tr>
<tr>
<td></td>
<td>*Cells/ mL 200 – 20 K (neutrophils)</td>
</tr>
<tr>
<td></td>
<td>*Protein (mg%): High (&gt; 100)</td>
</tr>
<tr>
<td></td>
<td>*Glucose (mg%): &lt; 45</td>
</tr>
<tr>
<td>Culture</td>
<td><em>Fastidious</em> (requires either ( X ) factors/ both which are present in blood):</td>
</tr>
<tr>
<td></td>
<td>a) ( X ) factor is a hemin (for aerobic respiration)</td>
</tr>
<tr>
<td></td>
<td>b) ( V ) factor is a coenzyme ( @ ) NAD/ NADP (H(^+) acceptor)</td>
</tr>
<tr>
<td></td>
<td>*Grows in <strong>blood/ chocolate</strong> agar (enriched media)</td>
</tr>
<tr>
<td></td>
<td><em>Levinthal’s</em>* medium (selective medium)</td>
</tr>
<tr>
<td>Biochem</td>
<td>*Catalase &amp; oxidase ( +ve )</td>
</tr>
<tr>
<td></td>
<td>*Ferments <strong>glucose &amp; xylose</strong> (with acid only)</td>
</tr>
<tr>
<td></td>
<td><em>Satelitism(^</em>) test ( +ve )</td>
</tr>
<tr>
<td>Ag detection</td>
<td><strong>LAT/ FAT/ Quellung’s test/ countercurrent immunoelectrophoresis</strong></td>
</tr>
</tbody>
</table>

\(^*\)Satelitism:
57. Pathogenesis:
   a) HSV-1 becomes latent in trigeminal ganglia while HSV-2 lumbar & sacral ganglia
   b) During latency, most of viral DNA is located in cytoplasm rather than integrated (into nuclear DNA)

58. HSV encephalitis:
   1. Is the commonest severe sporadic encephalitis
   2. Forms:
      a) Following 1st & generalized infection in infancy
      b) In adults due to virus reactivation in trigeminal ganglia, then infection passes back to temporal lobe (of brain)
   3. Herpetic skin mucosal lesions may be present
   4. Diagnosis is indicated by clinical signs of space-occupying lesion in temporal lobe & CT/radioactive brain scan
   5. Clinical findings:
      a) Acute onset, with fever & focal neurological symptoms
      b) Demonstration of HSV DNA in CSF by PCR (sensitive in acute stage)

#Previously, brain biopsy was done

59. HSV meningitis:
   a) Is a self-limiting disease
   b) CSF shows lymphocytic pleocytosis & may yield virus in culture

#Is a neurological condition in which a patient has migraine-type headache & also has lymphocytes present in spinal fluid

60. Lab diagnosis:
### Brain

- **Space-occupying lesions**

- **Headache, vomiting, seizures/epilepsy, cysticercotic encephalopathy**

<table>
<thead>
<tr>
<th>Eye</th>
<th>Uveitis, retinitis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Larvae visualized floating in vitreous humor</td>
</tr>
</tbody>
</table>

---

82. Lab diagnosis:

1. **Subcutaneous nodule biopsy**: shows *cysticerci*
2. **X-ray** of skull/soft tissue: shows *calcified cysticerci*
3. **CT/MRI scan** (to locate cyst)
4. **DLC**: eosinophilia
5. **Seroological tests** (to demonstrate specific Igs in serum), e.g.  
   a) **IHA** (indirect hemagglutination)  
   b) **IFA** (indirect fluorescent Ig)  
   c) **ELISA**

83. Treatment:

   a) **Praziquantel**
   b) **Albendazole**
   c) **Purgative**

*For such patients washing hands after defecation & safe disposal of feces for ≥ 4 days following therapy are must*
PART GB 02: URTIs

SUB-PART GB 02 (A): COMMON COLD

5. Causative agents:
   a) Rhino, corona, adeno, echo
   b) Coxsackie A
   c) Influenza, parainfluenza
   d) RSV
   e) *Mycobacterium pneumoniae*
   f) *Chlamydia pneumoniae*

6. Etiology & epidemiology:

   1. Caused by > 200 types of viruses
   2. 90% are due to viruses
   3. Distributed worldwide
   4. Seen mostly during winter
   5. *Rhinoviruses* are the most common agents (10 – 25%)

SUB-PART GB 02 (B): RHINOVIRUS

7. About:
   a) Small, non-enveloped with icosahedral nucleocapsid & +ve ssRNA
   b) NOT inactivated by lipid solvents
   c) Replicates better at 33°C than at 37°C
   d) No vaccine (as there are > 100 immunologically-distinct types)
   e) High infection frequency in childhood
   f) Humans are natural hosts

QUICK BYTZ

Rhinovirus – RNA
Nose is slightly colder than core temp (hence, better replication at 33°C)
| M protein (protein Ag) | *Anti-phagocytic  
*Antigenic  
*80 types of M protein are recognized |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C polysaccharide</td>
<td>Has toxic effect on connective tissue</td>
</tr>
<tr>
<td>Fimbriae</td>
<td>For attachment to surface epithelium (via lipoteichoic acid)</td>
</tr>
</tbody>
</table>
| Hemolysins (responsible for β-hemolysis) | *Streptolysin ‘O’ (O₂ labile)  
*Streptolysin ‘S’ (O₂ stable) |
| Exotoxins             | *Exotoxin A (erythrogenic toxin, pyogenic)  
*Exotoxin B |
| Others                | *Streptokinase (fibrinolysin)  
*Hyaluronidase  
*Deoxyribonucleases (streptodornase, DNAase)  
*Nicotinamide adenine dinucleotidase (NADase) |

21. **Pathogenesis:**

Glycoprotein fibronectin on epithelial cell serves as lipoteichoic acid ligand

Virulent group A streptococci adhere to pharyngeal epithelium by means of lipoteichoic acid covering the surface pili

Localization favoured by hypersensitivity (due to prior contact)

Pharyngitis (sore throat)

22. **Clinical features:**
### Rheumatic fever

Igs formed to Ags (in streptococcal cell wall) cross-react with sarcolemma of heart & other tissues

Granulomas formed in heart (Aschoff’s nodules – see diagram below)

Patient develops myo-/peri-carditis, which may be associated with...

a) subcutaneous nodules
b) polyarthritis
c) chorea (results from streptococcal Igs reacting with neurones)

### Rheumatic heart disease

Immune-mediated disease

Due to repeated attacks of Strep. pyogenes with different M protein types

Lead to damage to heart valves

### Acute glomerulonephritis

Igs to streptococcal components combine with them to form circulating immune complexes (Ag-Ig complexes) → deposited in glomeruli, together with autolgs to glomerular components

Complement & coagulation systems activated → local inflammation

Blood appears in the urine (RBCs, protein)

Signs of acute nephritis syndrome (edema, hypertension) present

ASO (anti-streptolysin O) Igs are usually ↑

### Otitis media

### Sinusitis/ mastoiditis

### Ludwig’s angina

### Suppurative adenitis

### Meningitis
## 28. Pathogenesis

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>*Infection in children &amp; adults are <strong>asymptomatic</strong> (EXCEPT in the immunocompromised)</td>
</tr>
<tr>
<td></td>
<td>*1° site of latency: <strong>monocytes</strong></td>
</tr>
<tr>
<td></td>
<td>*Others: <strong>kidneys</strong> (for years)/ cervix</td>
</tr>
<tr>
<td><strong>Reaction</strong></td>
<td>*Occurs when <strong>CMI ↓</strong></td>
</tr>
<tr>
<td></td>
<td>*Reactivation in <strong>cervix → infection</strong> of <strong>newborn</strong> when passing thru birth canal</td>
</tr>
<tr>
<td><strong>Pathogenesis proper</strong></td>
<td>*CMV infection occurs via <strong>immunosuppressive</strong> effect (by inhibiting CTCs)</td>
</tr>
<tr>
<td></td>
<td>*Host defences: <strong>CMI</strong> (more important) &amp; circulating <strong>Igs</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Immune evasion</strong> mechanism (maintains long, latent state):</td>
</tr>
<tr>
<td></td>
<td>*CMV also encodes several <strong>microRNAs</strong> which prevent translation of mRNA → <strong>MHC c1</strong> protein:</td>
</tr>
<tr>
<td></td>
<td>a) Again, there is <strong>no Ag presentation</strong></td>
</tr>
<tr>
<td></td>
<td>b) No CTC killing of infected cells</td>
</tr>
</tbody>
</table>

### Diagram

- **Cells infected**
  - Unstable assembly of **MHC c1-viral peptide complex**
  - **No Ag presentation on cell surface**
  - **No CTC killing of infected cells**

**QUICK BYTZ**

CTCs cannot present Ags due to defective **MHC c1**, & this...  
Very much ↓ CTC killing of infected cells

## 29. Clinical features:

<table>
<thead>
<tr>
<th></th>
<th>In the Immunocompromised</th>
<th>In the Immunocompetent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### About:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Classification** | *γ-herpesvirus*  
  *Structurally similar to other herpesviruses, but antigenically different* |
| **Ags** | *Viral capsid Ags (VCAs)*  
  *EBV early Ags (EAs)*  
  *EBV nuclear Ag (EBNA)*  
  *Lymphocyte-determined membrane Ag*  
  *Viral membrane Ag* (this is the main target for neutralization) |
| **Infection** | *Humans are natural hosts*  
  *Infects lymphoid cells (esp. B cells) & epithelial cells of oropharynx → sore throat*  
  *In latently-infected cells, EBV DNA no incorporate into cellular DNA*  
  *Infects very young children (age 1 – 6) & adolescents (age 14 – 20)* |
| **Subtypes** | *EBV-1 (type A): present in Western countries*  
  *EBV-2 (type B): less virulent* |

### Transmission:

1. **Oral secretions** (saliva) – during kissing

2. Blood, **transplanted** organs (less common than CMV)

3. **Intrauterine** (rare, but if infected, no viral transmission to fetus or adverse fetal outcomes)

4. **Miscellaneous**
   a) Asymptomatic infection during 1st few years of life
   b) Early infection occurs in **lower socioeconomic** groups
   c) High frequency in those exposed later in life
| **Fimbria** | *For bacterial **attachment** to **respiratory epithelium**  
*Also helps in **serotyping** |
| **Filamentous HA** | *Present on bacterial surface  
*Helps in **attachment** & facilitates 2° infections  
**Protective** (produces **immune response** which protects **host**) |
| **AC toxin** | *Causes ↑ cAMP  
*Inhibits **bactericidal activity** of **phagocytes** |
| **Tracheal cytotoxin** | *Is a **peptidoglycan fragment**  
*Kills **tracheal epithelial cells** (due to inhibition of DNA synthesis) |
| **Pertactin** | Is an **outer membrane protein** (can be used as vaccine) |
| **Endotoxin** | *Is a **LPS**  
*(Along with tracheal cytotoxin,) ↑ IL-1 & NO synthesis  →  cell damage |

*Fimbrial agglutinogen & filamentous HA are **adhesins**

70. **Clinical features (phases & their features):**

| **Catarrhal** | *Mild symptoms  
*Highly infective stage |
| **Paroxysmal** | • Characterized by **cough** bouts → rushing of **air** into **empty lungs** → **whoop** |
| **Convalescence** | • Recovery phase |

*Each phase lasts ≈ 2 weeks*
1. ≈ 2 B @ 1/3 of world’s population are affected with tubercle bacilli
2. Every year, 8 – 9 M new cases appear, with 3 M deaths
3. Majority cases & deaths are from poor nations (e.g. India)
4. In India, > 40% of the population is infected & 15 M suffer from TB. 0.5 M die from this every year

b) General:

1. TB is highly associated with poverty (TB has declined rapidly in rich nations due to ↑ living standards)
2. HIV & TB are closely related, in which HIV infections can cause...
   a) reactivation of latent TB infections
   b) worsening of TB
   c) treatment of TB to be ineffective
3. Emergence & spreading of MDRTB worsens the situation (WHO once declared TB as a global emergency)

#TB in turn may hasten development of HIV infection into active disease

76. Transmission:

1. Source of bacteria: open case of TB
2. Transmitted via droplets during sneezing, coughing, talking
3. Tiny droplets remain suspended in air for long & get access to terminal air passages
4. Direct inhalation of aerosolized bacilli in droplet nuclei of expectorated sputum → infection
5. Spread occurs among household/ prolonged contact with open cases

*Majority of inhaled bacilli are arrested in URT
98. Predisposing factors:
   a) Alcoholism
   b) Patients on ventilators
   c) Immunocompromised
   d) DM

99. Virulence factors:
   a) Adhesins
   b) Pili
   c) Capsular- & lipo-polysaccharide

100. Pathogenesis & clinical features:

101. Lab diagnosis:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimens</td>
<td>Sputum</td>
</tr>
<tr>
<td>Gram staining</td>
<td>Gram (-) bacilli, capsulated</td>
</tr>
</tbody>
</table>
Culture

MA (McConkey agar): pink mucoid colonies

Biochem tests

* Catalase, citrate, urease +ve
* Reduces NO₃
* TSI test: A/A (yellow slant & butt)
* Ferments sugars (+)
* Non-motile
* Oxidase –ve

SUB-SUB-PART GB 03 (E 4): 1° ATYPICAL PNEUMONIA

SUB-SUB-SUB-PART GB 03 (E 4a): OVERVIEW

102. Definition:
   a) “1°” refers to pneumonia occurring as a new event (not 2° to influenza)
   b) “Atypical” refers to the fact that Strep. pneumoniae is not isolated from sputum of such patients; symptoms are often general & respiratory-related; pneumonia fails to respond to penicillin or ampicillin

103. Etiological agents:
   a) *Mycoplasma pneumoniae*
   b) *Legionella pneumophila*
   c) *Coxiella burnetti*
   d) *Chlamydia pneumoniae/ psittaci*
106. General
   a) Belong to Myxovirus family (interact with mucins), Orthomyxoviridae subfamily
   b) Enveloped RNA viruses
   c) Have ability to adsorb on mucoprotein receptors of RBCs, causing hemagglutination

107. Structure:
   1. **Enveloped**, spherical virus
   2. Contains segmented –ve ssRNA
   3. Has RNA-dependent RNA Pol
   4. **Helical nucleocapsid**, surrounded by M (matrix/ membrane) layer (which is protein in nature)
   5. Outer lipid bilayer is derived from host membrane during budding

**QUICK BYTZ**

Influenza has no matching properties:

Influenza – RNA – Helical nucleocapsid

108. Antigenic structure:
   a) Major Ags: internal Ags (RNP & M proteins) & envelope Ags (HA & NA)
   b) RNP & M layer are **group-specific** Ags. They are **stable** (no show any antigenic variation)
   c) Envelope Ags are **host-specific**
**SARS**

- *Family: Coronavirus*
- Non-segmented, +ve ssRNA genome
- *Enveloped, with helical nucleocapsid*
- *No virion polymerase*
- *Incubation period ranges from 2 – 10 days (average 5)*

- *Severe atypical pneumonia*
  (characterized by fever $\geq 38^\circ C$)
- Dyspnea
- Hypoxia $\rightarrow$ diffuse edema
- *Non-productive cough*
- Chills
- Rigors
- Malaise
- Headache
- Sore throat
- Coryza (rhinorrhea, runny nose)

*Most adenovirus infections resolve spontaneously*

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**SUB-SUB-PART GB 03 (F 3): MEASLES**

119. Complications (with respect to 2° bacterial pneumonia):

- Virus replicates in epithelium of nasoopharynx, middle ear & lung
- Interferes with host defences & enables bacteria (e.g. pneumo-/ staphylo-/ meningo-cocci) to establish 2° infections
- Virus replication continues unchecked (in children with severely impaired immune responses)
- Giant cell (2°) pneumonia (rare & usually fatal)
120. General properties:

1. Important cause of pneumonia in immunocompromised individuals

2. Medically, it is thought of as a protozoa because...
   a) it appears as cyst in tissue
   b) its cysts resemble those of protozoa

3. Subsequent analysis of mitochondrial DNA & various enzymes support the idea that it is a fungus. However,...
   a) it has no ergosterol in its membrane as fungi should have (it has cholesterol instead)
   b) it NO grow in fungal media
   c) anti-fungal drugs are ineffective on them

4. Found in domestic animals (horse, sheep, variety of rodents), but they are NOT reservoirs for human infection

5. Has major surface glycoproteins (hence, exhibit significant antigenic variation)

6. Has multiple genes encoding these surface proteins (but only 1 expressed at a time)

121. Morphology:

<table>
<thead>
<tr>
<th>Trophozoite</th>
<th>Pre-cyst</th>
<th>Cyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Thin wall</td>
<td>*Is an intermediate stage of sexual phase</td>
<td>*Thick wall</td>
</tr>
<tr>
<td>*Irregular shape</td>
<td>*Size: 5 – 8 mm</td>
<td>*Spherical</td>
</tr>
<tr>
<td>*Size: 1 – 5 mm</td>
<td></td>
<td>*Contains up to 8 intracystic bodies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Size: up to 8 mm</td>
</tr>
</tbody>
</table>
**SUB-SUB-PART GB 03 (G 2): ASPERGILLUS FUMIGATUS/ FLAVIUS**

125. General properties:

1. Are **filamentous fungi/molds**

2. Have **septate hyphae** (multicellular) forming V shape (dichotomous branches)

3. **Cell walls** are (more or less) **parallel**

4. **Conidia** form **radiating chains**

5. **Reproduce** by **spore** formation (asexually), but some undergo **sexual** reproduction

6. Appearance:
   a) Macroscopic: surface texture is **cottony/ wooly/ velvety/ granular**, **pigmentation** may be observed from the reverse
   b) Microscopic: thread-like **filamentous hyphae** (in tissues & culture)

7. **Cause** opportunistic mycoses

8. **Infect immunocompromised** patients (due to immunosuppressive drugs, DM, HIV) by various mechanisms

126. Transmission: **inhalation** of spores (airborne droplets)

127. Clinical features:

<table>
<thead>
<tr>
<th>Feature</th>
<th>About</th>
<th>Sub-features</th>
</tr>
</thead>
</table>
| (ABPA) allergic broncho-pulmonary aspergillosis | Allergic response due to aspergillus Ags in lungs | *Asthma* (due to type I hypersensitivity) – occurs in atopic individuals following sensitization to inhaled spores  
*Extrinsic alveolitis* (type III hypersensitivity)  
*Eosinophilia*  
*High IgE titre*  
*Expectorate: brownish bronchial plugs containing hyphae* |
| Invasive aspergillosis | Causes pneumonia, then disseminates to involve other organs (brain, kidney, heart) | *Extreme tiredness*  
*Excessive weakness*  
*Severe headache*  
*Delirium*  
*Hemiplegia* |
|-----------------------|---------------------------------------------------------------------------------|--------------------------------------------------|
| Aspergilloma          | *Aspergilli colonize cavities in lungs (due to pre-existing lung cavities)*  
*They grow & produce a fungal ball (aspergilloma = a mass of entangled hyphae), invading lung airways* | *Massive hemoptysis*  
*Bronchitis*  
*Dyspnea*  
*Fever*  
*Chest pain* |
| Superficial infections | Aspergilli colonize & invade abraded skin, wounds, burns, cornea, external ear, paranasal air sinuses | **Fungal sinusitis** |

128. Lab diagnosis:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimens</td>
<td><em>Sputum, tissue sections (biopsy/post-mortem material)</em></td>
</tr>
</tbody>
</table>
| Staining | *Septate hyphae demo:*  
  a) **PAS** staining  
  b) **Wet mount** of sputum (in 10% KOH)  

*Septate hyphae & conidiophores* demo:  
 a) **LPCB** staining  
 b) **Conidiophores** show **swollen, rounded ends** (vesicles)  
 c) **Spores** in **chains** on **elongated cells** (sterigmata) |