Evasion of Immune System By Bacteria

- Bacteria employ different ways to evade the immune system. These mechanisms include:
  
  I. Resistant coat to protect the bacteria from lysozyme action (e.g. the outer protective wax of *C. pseudotuberculosis*).
  
  II. Evade exposure to enzymes by interfering with phagosomal maturation.

**Fig. Major mechanisms of immune evasion by bacteria**
Evasion of Immune System By Bacteria

For example:

- S. enterica typhimurium prevents assembly of the NOX complex
- Mycobacteria, Aspergillus flavus, B. abortus, and Chlamydophila psittaci establish themselves in vacuoles that exclude proteases and oxidants by blocking lysosome-phagosome fusion
- M. tuberculosis enters macrophages via cholesterol-enriched membrane microdomains to prevent phagosome maturation.
- Mycobacteria also prevent acidification of phagosome

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III. Persist free in the cytoplasm being surrounded by a coat of polymerized actin. Mycobacteria and L. monocytogenes employ this method.

IV. Manipulating the host’s cytokine response to their advantage

- Suppression of T cell response by Mycobacteria by inducing synthesis of regulatory cytokines (IL-6, IL-10 and TGF-B) by the host cells.

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- Protection against intracellular bacteria is mediated by macrophage activation.
- Macrophage activation is mediated by INF-gamma released from sensitised Th1 cells.
- The response of activated macrophages is non-specific and destroys many normally resistant bacteria
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**Facultative Intracellular Bacteria and Their Mechanisms of Survival**

<table>
<thead>
<tr>
<th>Organism</th>
<th>Method of Intracellular Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucella abortus</td>
<td>Resistant cell wall</td>
</tr>
<tr>
<td>Campylobacter jejuni</td>
<td>Prevents phagosome maturation</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Prevents phagosome maturation</td>
</tr>
<tr>
<td>Listeria monocytogenes</td>
<td>Neutralizes respiratory burst</td>
</tr>
<tr>
<td>Mycobacterium intracellulare</td>
<td>Escapes into the cytosol</td>
</tr>
<tr>
<td>Anaplasma marginale</td>
<td>Liquid cell wall</td>
</tr>
<tr>
<td>Salmonella enterica</td>
<td>Prevents phagosome maturation</td>
</tr>
<tr>
<td>Rhodobacter capsulatus</td>
<td>Survives in phagosomes</td>
</tr>
</tbody>
</table>

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**Evasion of The Immune System By Bacteria**

- Invading microorganisms become pathogen when they evade the host’s immune system.

Strategies used by bacteria to evade immune responses.

I. Prevention of Recognition

- Continuous change of surface coats (e.g., *Campylobacter jejuni* ssp. *Veneralis*).

- Sequential antigenic variation (e.g., *Anaplasma marginale*).

II. Resistance to Effector Mechanisms

- Effectively block phagocytosis, Fc receptor function, cytotoxic T cell function, or complement activity.

- Many bacteria survive within phagocytic cells.

- Some bacteria prevent recognition by phagocytic receptors. (e.g., *S. aureus* inhibits phagocytosis by means of protein A on its surface).

- Interfere with complement activation (e.g., *S. pyogenes* & *S. pneumoniae*).
Evasion of The Immune System By Bacteria

- Some bacteria secrete molecules that depress phagocytosis by neutrophils (e.g. Enteropathogenic E. coli, Y. pestis, M. tuberculosis, Pseudomonas aeruginosa)
- Several gram-negative bacteria of veterinary importance such as Mannheimia hemolytica, S. aureus, and Fusobacterium necrophorum, secrete leukotoxin bacteria.
- Some bacteria reduce the killing ability of phagocytes.

Immunity to Fungal Infections

- Innate immune response against invasive fungi such as Candidia and Aspergillus
- Activation of complement system (the alternative pathway)
- Attract neutrophils to the site of invasion
- Ingest the invading hyphae/pseudohyphae

Immunity to Fungal Infections

- Very small fungal fragments or spores may be ingested and destroyed by macrophages or by NK cells.
- Established fungal infections are only destroyed by T-cell mediated mechanisms.
- T-cells activate macrophages and promote epidermal growth and keratinization.
- Some T and NK cells can have direct cytotoxic effects on yeasts such as C.neoformans and C. albicans.