

Edexcel (B) Biology A-level

6.2 - Bacteria as pathogens

6.3 - Action of antibiotics

6.4 - Antibiotic resistance

Flashcards

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Why are bacteria described as agents of infection?



Why are bacteria described as agents of infection?

- Produce exotoxins.
- Endotoxins on surface trigger immune response.
- Invade & destroy host tissues.



How does *Salmonella* spp. cause disease?



How does *Salmonella* spp. cause disease?

Gram negative bacterium with lipopolysaccharide **endotoxins on outer membrane**. Triggers release of proinflammatory cytokines. Acute inflammation results in diarrhoea. Releases endotoxins into host when bacterium dies.



How does *Staphylococcus* spp. cause disease?



How does *Staphylococcus* spp. cause disease?

Secretes soluble proteins called exotoxins e.g. :

- Barrel-shaped proteins embed in host cell membrane so contents leak.
- Protease toxins.
- Superantigens trigger 20% of T cells (usual 0.001%) so can cause toxic shock.



How does *Mycobacterium tuberculosis*
cause disease?



How does *Mycobacterium tuberculosis* cause disease?

1. Triggers inflammatory response by infecting phagocytes in lungs.
2. Infected phagocytes are sealed in waxy-coated tubercles so bacteria remain dormant. First infection has no symptoms.
3. If another factor weakens immune system, bacteria become active & **destroy lung tissue.**



How does penicillin work?



How does penicillin work?

Beta-lactam **bactericidal antibiotic.**

Prevents formation of peptidoglycan cross-links in bacterial cell wall, causing osmotic lysis.



How does tetracycline work?



How does tetracycline work?

Bacteriostatic antibiotic. Prevents protein synthesis by binding to small subunit of ribosome so tRNA cannot attach. Therefore inhibits growth & division.

NB: bacteriostatic antibiotics may also inhibit nucleic acid formation



What causes antibiotic resistance?



What causes antibiotic resistance?

1. Random genetic mutation, often on plasmid, confers resistance e.g. antigen shape changes.
2. These bacteria have selective advantage in the presence of antibiotics, reproduce & pass allele for resistance to offspring.
3. Directional selection results in resistant strain.



What causes antigen variability?



What causes antigen variability?

1. Random genetic mutation changes DNA base sequence.
2. Results in different sequence of codons on mRNA
3. Different primary structure of antigen = H-bonds, ionic bonds & disulfide bridges form in different places in tertiary structure.
4. Different shape of antigen.



Explain how antigen variability affects the incidence of disease.



Explain how antigen variability affects the incidence of disease.

- Memory cells no longer complementary to antigen = individual not immune = can catch the disease more than once / cannot recognise pathogen e.g. HIV.
- Many varieties of a pathogen = difficult to develop vaccine containing all antigen types.



How do hospitals minimise the spread of antibiotic resistant bacteria?



How do hospitals minimise the spread of antibiotic resistant bacteria?

- Screening & quarantine of affected patients.
- Hygiene code of practice e.g. alcohol-based antibacterial gels.
- Antibiotics prescribed only when necessary & course completed to minimise selection pressure.



Why is it so difficult to control the spread of antibiotic-resistant bacteria?



Why is it so difficult to control the spread of antibiotic-resistant bacteria?

Horizontal conjugation transfers plasmids with resistance allele from one bacterium to another rapidly.

