

First 2009
VIVA 4

This station will explore your knowledge of bacteria and anti-bacterial agents. How do bacteria differ from the majority of normal human cells (eukaryotes)?

“How do bacteria differ from a majority of normal human cells?”

- single celled organisms
- nucleus is not membrane bound
- less organelles, usually limited to ribosomes for protein production
- contain plasmids which contain genetic material and facilitate diversification of bacteria
- reproduce asexually by producing genetic material before dividing

“How are antibacterial agents classified?”

- by their spectrum of action narrow or broad, gram negative or gram positive
- chemical structure (eg aminoglycosides by the position of the amino group)
- mechanism of action

“Describe some common antibiotic classes with examples and their mechanism of action?”

- inhibit cell wall synthesis
 - beta-lactams
 - penicillins - penicillin G, ampicillin
 - cephalosporins - ceftriaxone
 - carbapenems - meropenem
 - glycopeptides - vancomycin
- Inhibit protein synthesis
 - macrolides - binds 50S - erythromycin
 - aminoglycosides - binds 30S - gentamicin
 - tetracycline - binds 30S
- inhibit nucleic acid synthesis
 - quinolones - acts on DNA gyrase - ciprofloxacin
 - sulphonamides - folic acid synthesis - sulfazidine
 - metronidazole - DNA strand breakage

“Describe mechanisms of bacterial resistance to antibiotics?”

- Mutation in the cell wall
 - MRSA and the mutation of penicillin binding proteins
- Enzyme production
 - staphylococcal production of beta lactamases
- Point mutations in ribosomal proteins
 - aminoglycosides and the 30S ribosome
- Oxygen rich environments are changed to anaerobic
 - aminoglycosides and penetration into the inner membrane
- modifications in the cell outer layers to prevent porin access
 - aminoglycosides require access via porins
- efflux mechanisms which pump the antibiotic out of the bacteria
 - tetracyclines and staph aureus
- bypassing the mechanism of action
 - trimethoprim and alternative folate production pathways by haemophilus influenza

“How does resistance develop?”

- Sub optimal dosing and natural selection
- Transfer of DNA material via plasmids
 - Between bacteria by conjugation, transduction and transformation