Antibiotics
Consequences of inappropriate antibiotic therapy

- Inappropriate antibiotic therapy can lead to increases in:
  - mortality
  - morbidity
  - resistance selection
Inappropriate antibiotic therapy can be defined as:

- ineffective empiric treatment of bacterial infection
- the wrong choice, dose or duration of therapy
- use of an antibiotics to which the bacterial pathogens are resistant
Clinical evidence suggests that use of appropriate antibiotic therapy improves patient outcomes in terms of:

- reduced mortality
- reduced morbidity
**Antibiotic mode of action:**

- Cell wall synthesis inhibitors
- Protein synthesis inhibitors
- Nucleic acid synthesis inhibitors
- Cytoplasmic membrane function inhibitors
- Other agents that affect DNA
Cell wall synthesis inhibitors

- Antibiotics that inhibit bacterial cell wall synthesis include:
  - β-lactams: penicillins, cephalosporins, carbapenems, monobactams
  - glycopeptides: vancomycin, teicoplanin
  - bacitracin
Protein synthesis inhibitors

- Antibiotics that inhibit bacterial protein synthesis include:
  - aminoglycosides: gentamicin, tobramycin, amikacin, netilmicin, streptomycin, isepamicin
  - tetracyclines
  - MLS group: macrolides (e.g., erythromycin), lincosamides, streptogramins (e.g., quinupristin–dalfopristin)
  - chloramphenicol
  - oxazolidinones
Nucleic acid synthesis inhibitors

- Antibiotics that inhibit bacterial nucleic acid synthesis include:
  - precursor synthesis inhibitors: sulphonamides, trimethoprim
  - DNA replication inhibitors: quinolones
  - RNA polymerase inhibitors: rifampicin
Cytoplasmic membrane function inhibitors

- Polymyxins
Other agents that affect DNA

- Nitroimidazoles
Resistance to antibacterial agents

• Antibiotic resistance is a result of innate consequences or is acquired from other sources

• Bacteria acquire resistance by:
  – mutation
  – addition of new DNA
Mechanisms of antibacterial resistance (1)

• Modification of antibiotic target site, resulting in:
  – reduced antibiotic binding
  – formation of a new metabolic pathway
Mechanisms of antibacterial resistance (2)

- Changed uptake of antibiotics, resulting in:
  - decreased permeability
  - increased efflux
Mechanisms of antibacterial resistance (3)

- Inactivation of antibiotics
  - production of enzymes that inactivate antibiotics
    - β-lactamases
    - aminoglycoside-modifying enzymes