UNIT – 2

Chemotherapy

a. General Principles of Chemotherapy:

1. Definition:

- Chemotherapy involves the use of chemical agents to treat diseases, primarily focusing on cancer treatment.

2. Principles:

- **Selective Toxicity:** Targeting rapidly dividing cells, especially cancer cells.
- **Combination Therapy:** Using multiple drugs to target different aspects of cancer cells.
- **Dose Intensity:** Administering drugs at optimal doses and intervals.
- **Drug Resistance Management:** Addressing and overcoming resistance mechanisms.

3. Classes of Chemotherapeutic Agents:

- **Cytotoxic Agents:** Directly kill or inhibit the growth of cancer cells.
- **Targeted Therapies:** Aim at specific molecules involved in cancer growth.
- **Immunotherapies:** Boost the body's immune system to fight cancer.

b. Sulfonamides and Cotrimoxazole:

1. Sulfonamides:

- **Mechanism:** Inhibit dihydropteroate synthase, disrupting folic acid synthesis in bacteria.
- **Applications:** Antibacterial agents against various infections.

2. Cotrimoxazole:

- **Composition:** Combination of sulfamethoxazole (sulfonamide) and trimethoprim.
- **Synergistic Effect:** Blocks sequential steps in folic acid synthesis.
- **Usage:** Treatment of bacterial infections, especially urinary tract infections.

c. Antibiotics:

1. Penicillins:

- **Mechanism:** Inhibit bacterial cell wall synthesis by binding to penicillin-binding proteins.
- **Classes:** Natural penicillins (e.g., Penicillin G), penicillinase-resistant penicillins (e.g., Dicloxacillin), extended-spectrum penicillins (e.g., Amoxicillin).

2. Cephalosporins:

- **Mechanism:** Similar to penicillins, targeting bacterial cell wall synthesis.
- **Generations:** First-generation (e.g., Cephalexin), second-generation (e.g., Cefuroxime), third-generation (e.g., Ceftriaxone), fourth-generation (e.g., Cefepime).

3. Chloramphenicol:

- **Mechanism:** Inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit.
- **Usage:** Broad-spectrum antibiotic with potential side effects limiting its use.

4. Macrolides:

- **Examples:** Erythromycin, Clarithromycin, Azithromycin.
- **Mechanism:** Inhibit bacterial protein synthesis by binding to the 50S ribosomal subunit.
- **Usage:** Respiratory tract infections, skin infections.

5. Quinolones and Fluoroquinolones:

- **Examples:** Nalidixic Acid, Ciprofloxacin, Levofloxacin.
- **Mechanism:** Inhibit bacterial DNA gyrase or topoisomerase, disrupting DNA replication.
- **Usage:** Broad-spectrum antibiotics for various infections.

6. Tetracyclines:

- **Examples:** Tetracycline, Doxycycline.
- **Mechanism:** Inhibit bacterial protein synthesis by binding to the 30S ribosomal subunit.
- **Usage:** Broad-spectrum antibiotics for respiratory, urinary, and skin infections.

7. Aminoglycosides:

- **Examples:** Streptomycin, Gentamicin.
- **Mechanism:** Inhibit bacterial protein synthesis by binding to the 30S ribosomal subunit.
- **Usage:** Particularly effective against Gram-negative bacteria.

These comprehensive notes cover the general principles of chemotherapy, the pharmacology of sulfonamides and cotrimoxazole, and the major classes of antibiotics, including penicillins, cephalosporins, chloramphenicol, macrolides, quinolones, fluoroquinolones, tetracyclines, and aminoglycosides.