

Unit-3

Pharmacology- III

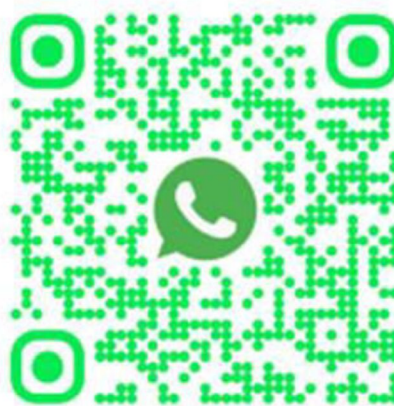
B.Pharma 6th Sem Notes

Unit: 3

3. Chemotherapy

- A. Antitubercular agents**
- B. Antileprotic agents**
- C. Antifungal agents**
- D. Antiviral drugs**
- E. Anthelmintics**
- F. Antimalarial drugs**
- G. Antiamoebic agents**

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A. Antitubercular Agents

Definition:

- Antitubercular agents are drugs used to prevent or treat **tuberculosis (TB)**—a chronic infectious disease caused mainly by *Mycobacterium tuberculosis*.
- These drugs either kill the bacteria (**bactericidal**) or inhibit their growth (**bacteriostatic**).

Classification:

A. First-Line Drugs (Primary drugs – more effective, less toxic)

1. Isoniazid (INH)
2. Rifampicin
3. Pyrazinamide
4. Ethambutol
5. Streptomycin

B. Second-Line Drugs (Used when resistance/toxicity to first-line drugs occurs)

1. Ethionamide
2. Capreomycin
3. Cycloserine
4. p-Aminosalicylic acid (PAS)
5. Kanamycin, Amikacin, Levofloxacin, Moxifloxacin (Fluoroquinolones)

Antitubercular Drugs:

1. Isoniazid (INH):

- **Definition:** Most potent first-line drug for TB; synthetic hydrazide of isonicotinic acid.
- **Mechanism of Action:** Inhibits **mycolic acid synthesis** (essential component of mycobacterial cell wall) → bactericidal for actively growing bacilli.
- **Uses:**
 - Treatment of active TB (in combination with other drugs)
 - Prophylaxis in high-risk individuals (contacts of TB patients)
- **Adverse Effects:**
 - Peripheral neuritis (due to pyridoxine deficiency)
 - Hepatitis, rash, fever
 - CNS toxicity (seizures, memory issues)
- **Note:** Pyridoxine (Vit. B6) is given to prevent neuritis.



2. Rifampicin:

- **Definition:** Broad-spectrum bactericidal antibiotic derived from *Streptomyces*; key TB drug.
- **Mechanism of Action:** Inhibits **DNA-dependent RNA polymerase** → blocks RNA synthesis in bacteria.
- **Uses:**
 - All forms of TB (pulmonary & extrapulmonary)
 - Leprosy, meningococcal prophylaxis
 - Certain bacterial infections resistant to other drugs
- **Adverse Effects:**
 - Hepatotoxicity
 - Flu-like symptoms
 - Red–orange discoloration of urine, sweat, tears (harmless but alarming to patients)
 - GI upset

3. Pyrazinamide:

- **Definition:** Nicotinamide derivative; highly effective against intracellular bacilli in acidic environment.
- **Mechanism of Action:** Converted to **pyrazinoic acid** in bacteria → disrupts membrane transport & energy production.
- **Uses:**
 - Short-course TB regimens (first 2 months)
- **Adverse Effects:**
 - Hepatotoxicity
 - Hyperuricemia → gout
 - Arthralgia

4. Ethambutol:

- **Definition:** Synthetic, bacteriostatic anti-tubercular drug.
- **Mechanism of Action:** Inhibits **arabinosyl transferase** → blocks synthesis of arabinogalactan (cell wall component).
- **Uses:**
 - Prevents resistance when used with other drugs in TB therapy
- **Adverse Effects:**
 - Optic neuritis (loss of red–green color vision)
 - Headache, confusion
 - GI upset

5. Streptomycin:

- **Definition:** Aminoglycoside antibiotic from *Streptomyces griseus*.
- **Mechanism of Action:** Inhibits **protein synthesis** by binding to 30S ribosomal subunit → bactericidal.
- **Uses:**
 - Severe or resistant TB (given IM)



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- **Adverse Effects:**
 - Ototoxicity (hearing loss, vertigo)
 - Nephrotoxicity
 - Neuromuscular blockade (rare)

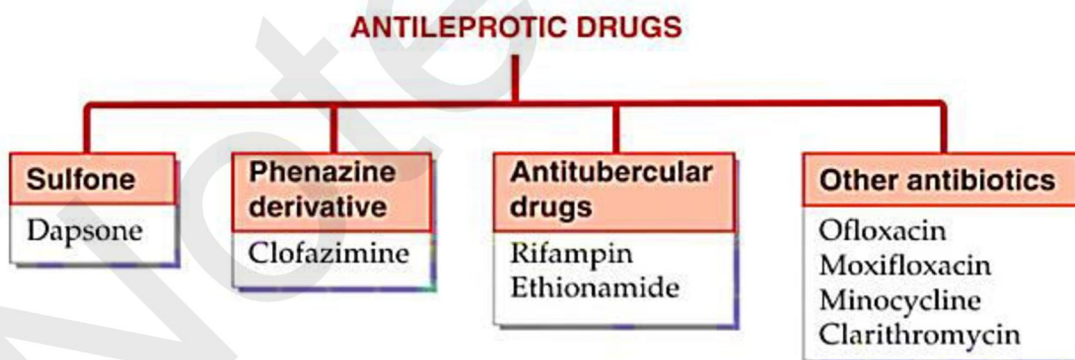
B. Antileprotic Agents

Definition

- Antileprotic agents are the drugs used for the treatment of **leprosy (Hansen's disease)** — a chronic infectious disease caused by *Mycobacterium leprae*.
- Their aim is to kill the bacteria, prevent disease progression, and reduce transmission.

Classification of Antileprotic Agents

1. **Primary (Main) Drugs**
 - **Dapsone**
 - **Rifampicin**
 - **Clofazimine**
2. **Alternative / Second-line Drugs**
 - Ofloxacin
 - Minocycline
 - Clarithromycin



1. Dapsone

Definition:

A synthetic sulfone drug, bacteriostatic against *M. leprae*. It is the oldest and most widely used antileprotic drug.

Mechanism of Action:

- Inhibits **dihydropteroate synthase** → blocks folic acid synthesis in bacteria → prevents bacterial growth.



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Uses:

- Main drug in Multidrug Therapy (MDT) for leprosy
- Also used in **dermatitis herpetiformis** and **pneumocystis pneumonia (PCP)** prophylaxis.

Adverse Effects:

- Hemolysis (especially in G6PD deficiency)
- Methemoglobinemia
- Peripheral neuropathy
- Skin rashes, pruritus

2. Rifampicin

Definition:

A semisynthetic antibiotic from *Streptomyces*, highly bactericidal against *M. leprae* and *M. tuberculosis*.

Mechanism of Action:

- Inhibits **DNA-dependent RNA polymerase** → blocks RNA synthesis in bacteria.

Uses:

- Multibacillary and paucibacillary leprosy (part of MDT)
- Tuberculosis, meningococcal prophylaxis.

Adverse Effects:

- Hepatotoxicity
- Orange-red discoloration of urine, sweat, and tears
- Gastrointestinal upset
- Flu-like syndrome

3. Clofazimine

Definition:

A phenazine dye with anti-inflammatory and bactericidal activity against *M. leprae*.

Mechanism of Action:

- Binds to mycobacterial DNA → inhibits growth.
- Also has anti-inflammatory effects to reduce lepra reactions.

Uses:

- Multibacillary leprosy (MDT component)
- Lepa reaction (type 2: erythema nodosum leprosum).



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Adverse Effects:

- Skin discoloration (red-brown to black)
- Gastrointestinal irritation
- Dry skin

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C. Antifungal Agents

Definition

Antifungal agents are drugs used to prevent or treat fungal infections (mycoses) by killing the fungus (fungicidal) or inhibiting its growth (fungistatic) without harming host tissues.

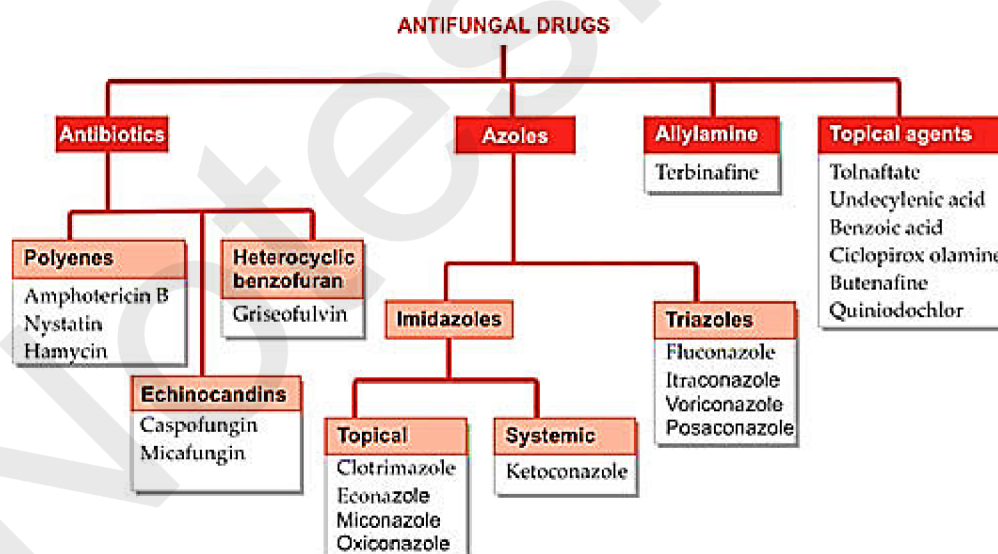
Classification of Antifungal Agents

1. Systemic Antifungals for Systemic Infections

- **Polyenes:** Amphotericin B, Nystatin (oral/topical)
- **Azoles:** Ketoconazole, Fluconazole, Itraconazole, Voriconazole
- **Echinocandins:** Caspofungin, Micafungin, Anidulafungin
- **Others:** Flucytosine, Griseofulvin

2. Topical Antifungals for Superficial Infections

- **Azoles:** Clotrimazole, Miconazole, Econazole
- **Allylamines:** Terbinafine, Naftifine
- **Others:** Tolnaftate, Ciclopirox



1. Amphotericin B (Polyene)

- **Definition:** Broad-spectrum antifungal used for severe systemic mycoses.
- **Mechanism of Action:** Binds to **ergosterol** in fungal cell membranes → forms pores → leakage of intracellular contents → cell death.
- **Uses:**
 - Systemic fungal infections (Histoplasmosis, Cryptococcosis, Blastomycosis, Candidiasis)



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- Aspergillosis
- **Adverse Effects:**
 - Fever, chills
 - Nephrotoxicity (kidney damage)
 - Hypokalemia
 - Anemia

2. Nystatin (Polyene)

- **Definition:** Topical/oral antifungal for Candida infections.
- **Mechanism:** Same as Amphotericin B (binds to ergosterol, damages membrane).
- **Uses:**
 - Oral thrush
 - Vaginal candidiasis
 - Cutaneous candidiasis
- **Adverse Effects:** Nausea, vomiting, skin irritation (topical).

3. Azoles (Ketoconazole, Fluconazole, Itraconazole, Voriconazole)

- **Definition:** Synthetic antifungals with broad-spectrum activity.
- **Mechanism:** Inhibit fungal **cytochrome P450 enzyme (14- α -demethylase)** → block conversion of lanosterol to ergosterol → disrupt membrane synthesis.
- **Uses:**
 - Systemic and superficial mycoses
 - Candida, Cryptococcus, Histoplasma, Aspergillus
 - Dermatophyte infections (skin, nails, hair)
- **Adverse Effects:**
 - Hepatotoxicity
 - GI upset
 - Endocrine effects (Ketoconazole → gynecomastia)

4. Echinocandins (Caspofungin, Micafungin, Anidulafungin)

- **Definition:** Newer antifungals for systemic Candida & Aspergillus.
- **Mechanism:** Inhibit **β -(1,3)-D-glucan synthase** → block fungal cell wall synthesis.
- **Uses:**
 - Invasive candidiasis
 - Invasive aspergillosis (when unresponsive to other drugs)
- **Adverse Effects:** Fever, rash, GI upset.

5. Flucytosine

- **Definition:** Antimetabolite antifungal, given orally.
- **Mechanism:** Converted inside fungal cells to 5-fluorouracil (5-FU) → inhibits DNA & RNA synthesis.
- **Uses:**
 - Combined with Amphotericin B for cryptococcal meningitis.
- **Adverse Effects:** Bone marrow suppression, GI upset.



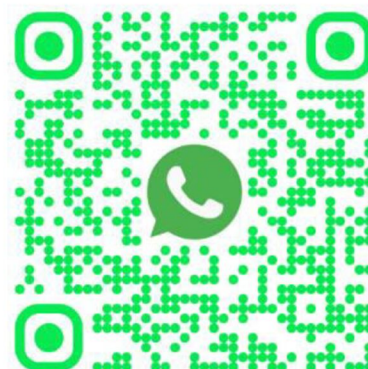
6. Griseofulvin

- **Definition:** Fungistatic drug for dermatophyte infections.
- **Mechanism:** Disrupts mitotic spindle → inhibits fungal mitosis.
- **Uses:**
 - Tinea infections (skin, hair, nails)
- **Adverse Effects:** Headache, GI upset, photosensitivity.

7. Terbinafine (Allylamine)

- **Definition:** Fungicidal drug for dermatophyte infections.
- **Mechanism:** Inhibits **squalene epoxidase** → decreases ergosterol synthesis.
- **Uses:**
 - Onychomycosis (nail fungal infection)
 - Tinea infections
- **Adverse Effects:** GI upset, hepatotoxicity, rash.

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D. Antiviral Drugs

Definition

- Antiviral drugs are medicinal agents used to prevent or treat **viral infections**.
- They work by inhibiting specific stages of the **viral life cycle** such as **attachment, entry, replication, transcription, protein synthesis, or release** of new viral particles.

Classification of Antiviral Drugs

Sr. No.	Class / Group	Example Drugs
1	Anti-Herpesvirus drugs	Acyclovir, Valacyclovir, Ganciclovir, Fanciclovir
2	Anti-CMV (Cytomegalovirus) drugs	Ganciclovir, Valganciclovir, Foscarnet
3	Anti-Influenza drugs	Oseltamivir, Zanamivir, Amantadine, Rimantadine
4	Anti-HIV drugs (Antiretrovirals)	Zidovudine (AZT), Lamivudine, Tenofovir, Efavirenz, Ritonavir
5	Anti-Hepatitis drugs	Interferon- α , Ribavirin, Sofosbuvir, Ledipasvir
6	Anti-RSV (Respiratory Syncytial Virus) drugs	Ribavirin, Palivizumab
7	Broad-spectrum antiviral drugs	Ribavirin, Interferons

Detailed Drugs Description

1. Acyclovir

- **Definition:** A guanine nucleoside analogue effective against HSV-1, HSV-2, and VZV.
- **Mechanism of Action:**
Activated by viral **thymidine kinase** → converted to acyclovir triphosphate → inhibits **viral DNA polymerase** → terminates viral DNA chain elongation.
- **Uses:**
 - Herpes simplex infections (oral/genital)
 - Varicella-zoster (chickenpox, shingles)
 - HSV encephalitis
- **Adverse Effects:**
 - Nausea, vomiting
 - Headache
 - Nephrotoxicity (crystalluria)
 - Neurotoxicity (rare)



2. Oseltamivir

- **Definition:** Neuraminidase inhibitor active against Influenza A and B.
- **Mechanism of Action:**
Inhibits viral **neuraminidase enzyme**, preventing release of new viral particles from infected cells.
- **Uses:**
 - Treatment and prevention of influenza A & B
- **Adverse Effects:**
 - Nausea, vomiting
 - Headache
 - Rare neuropsychiatric events

3. Zidovudine (AZT)

- **Definition:** A nucleoside reverse transcriptase inhibitor (NRTI) used in HIV treatment.
- **Mechanism of Action:**
Phosphorylated inside the host cell → inhibits **reverse transcriptase** → prevents viral DNA synthesis from RNA template.
- **Uses:**
 - HIV-1 and HIV-2 infection
 - Prevention of mother-to-child transmission
- **Adverse Effects:**
 - Bone marrow suppression (anemia, neutropenia)
 - Headache, fatigue
 - Myopathy (long-term use)

4. Sofosbuvir

- **Definition:** A nucleotide analogue used in chronic Hepatitis C virus (HCV) infection.
- **Mechanism of Action:**
Inhibits **NS5B RNA-dependent RNA polymerase**, preventing viral RNA replication.
- **Uses:**
 - Chronic HCV infection (often in combination with Ledipasvir or Ribavirin)
- **Adverse Effects:**
 - Fatigue, headache
 - Nausea
 - Insomnia

General Uses of Antiviral Drugs in Pharmacology

- Treatment of **acute viral infections** (e.g., influenza, herpes, hepatitis, HIV)
- **Prophylaxis** in high-risk individuals (e.g., influenza prevention in outbreaks)
- **Chronic viral suppression** (e.g., HIV, HBV)
- Prevention of **vertical transmission** (e.g., HIV mother-to-child)



E. Anthelmintics

Definition

- Anthelmintics are drugs used to **treat infections caused by parasitic worms (helminths)** such as **roundworms, tapeworms, and flukes**.
- They either **kill** the worms (**vermicide**) or **expel** them from the body (**vermifuge**) by affecting their biochemical processes.

Classification of Anthelmintics

Sr. No.	Class / Group	Example Drugs	Main Use
1	Benzimidazoles	Albendazole, Mebendazole, Thiabendazole	Broad spectrum – nematodes, cestodes
2	Imidazothiazoles	Levamisole	Roundworms
3	Tetrahydropyrimidines	Pyrantel pamoate	Roundworms, hookworms
4	Piperazine derivatives	Piperazine citrate	Ascaris, pinworms
5	Macrocyclic lactones	Ivermectin	Onchocerciasis, strongyloidiasis
6	Salicylanilides & Substituted phenols	Niclosamide	Tapeworms
7	Isoquinoline derivatives	Praziquantel	Schistosomiasis, cestodes, trematodes
8	Others	Diethylcarbamazine (DEC)	Filariasis

1. Albendazole

- **Definition:** A broad-spectrum benzimidazole derivative.
- **Mechanism of Action:**
Binds to **β -tubulin** in the parasite $\rightarrow$ inhibits microtubule synthesis $\rightarrow$ blocks glucose uptake $\rightarrow$ energy depletion $\rightarrow$ death of worm.
- **Uses:**
 - Roundworms (Ascaris, Enterobius)
 - Hookworms, whipworms
 - Tapeworms (cysticercosis)
 - Hydatid disease
- **Adverse Effects:**
 - Abdominal pain, nausea
 - Headache
 - Rare: liver enzyme elevation

2. Mebendazole

- **Definition:** Broad-spectrum benzimidazole similar to albendazole.



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- **Mechanism of Action:** Same as albendazole (microtubule inhibition, glucose depletion).
- **Uses:**
 - Ascariasis, trichuriasis, hookworm, enterobiasis
- **Adverse Effects:**
 - Mild GI upset
 - Rare hypersensitivity

3. Piperazine

- **Definition:** A simple heterocyclic compound used for roundworms.
- **Mechanism of Action:**
Causes **flaccid paralysis** of worms by blocking acetylcholine at neuromuscular junction → worms expelled by peristalsis.
- **Uses:**
 - Ascariasis
 - Enterobiasis (pinworms)
- **Adverse Effects:**
 - Nausea, vomiting
 - Rare neurotoxicity (ataxia, vertigo)

4. Ivermectin

- **Definition:** A macrocyclic lactone derived from *Streptomyces avermitilis*.
- **Mechanism of Action:**
Stimulates release of **GABA** in parasite → increases chloride ion influx → paralysis and death of worm.
- **Uses:**
 - Onchocerciasis (river blindness)
 - Strongyloidiasis
 - Filariasis (in combination therapy)
- **Adverse Effects:**
 - Pruritus, rash
 - Fever
 - Rare neurotoxicity

5. Praziquantel

- **Definition:** Isoquinoline derivative effective against trematodes and cestodes.
- **Mechanism of Action:**
Increases **calcium permeability** in parasite → sustained contraction → paralysis and death.
- **Uses:**
 - Schistosomiasis
 - Cestodes (tapeworms)
 - Clonorchiasis
- **Adverse Effects:**



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- Dizziness, headache
- GI upset
- Allergic reactions

6. Diethylcarbamazine (DEC)

- **Definition:** Piperazine derivative used in lymphatic filariasis.
- **Mechanism of Action:**
Immobilizes microfilariae and alters their surface, making them more susceptible to host immune attack.
- **Uses:**
 - Lymphatic filariasis (*Wuchereria bancrofti*, *Brugia malayi*)
 - Loiasis
- **Adverse Effects:**
 - Fever, headache
 - Mazzotti reaction (due to microfilariae death: rash, hypotension)

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F. Antimalarial Drugs

Definition:

- Antimalarial drugs are agents used to **prevent or treat malaria**, a disease caused by *Plasmodium* species (**P. falciparum, P. vivax, P. malariae, P. ovale, P. knowlesi**).
- They act by killing the parasite at various stages of its **life cycle** (blood stage, liver stage, or gametocyte stage).

Classification of Antimalarial Drugs

A. Based on Site of Action in Parasite Life Cycle

- Tissue schizontocides** (act on liver stage)
 - Primaquine, Tafenoquine
- Blood schizontocides** (act on asexual erythrocytic stage)
 - Chloroquine, Quinine, Mefloquine, Artemisinin derivatives, Atovaquone-proguanil
- Gametocytocides** (kill sexual forms in blood)
 - Primaquine (most effective), Artemisinin derivatives
- Sporontocides** (prevent development in mosquito)
 - Primaquine

Antimalarials	Classification	Mode of Action	Polymer Carriers	References
Primaquine	Hypnozoitocidal and gametocytocidal	Primaquine interferes with the electron transport in the parasite during respiration process	Nanoliposomes Dendrimers Polymer drug conjugates	57 63, 65 74, 77
Chloroquine	Blood schizontocides	Chloroquine accumulate in the acidic food vacuoles of intraerythrocytic trophozoites and thereby prevent haemoglobin degradation	Nanoliposomes Hydrogels Dendrimers	58 38, 39 54, 65
Artemisinin Dihydroartemisinin	Gametocytocidal	Involves the heme-mediated decomposition of the peroxide bridge to produce carbon-centred free radicals	Micelles Polymer-drug conjugates	47, 49 74
Curcumin	Blood schizontocides	Curcumin inhibits the activity of enzymes and lipid peroxides	Hydrogels	33, 34, 35
Artemether Beta-Artemether	Gametocytocidal	It acts against erythrocytic stages of <i>P. falciparum</i> and inhibits nucleic acid and protein synthesis.	Micelles Nanoliposomes	50 55
Lumefantrine	Blood schizontocides	Lumefantrine is believed inhibits nucleic and formation of β -hematin by forming a complex with hemin	Nanoliposomes Hydrogels	56 37



B. Based on Chemical Class

Class	Examples
4-Aminoquinolines	Chloroquine, Amodiaquine
Quinoline-methanol	Quinine, Mefloquine
Artemisinin derivatives	Artemether, Artesunate, Dihydroartemisinin
Diaminopyrimidines	Pyrimethamine
Sulfonamides	Sulfadoxine
Naphthoquinones	Atovaquone
8-Aminoquinolines	Primaquine, Tafenoquine

Important Drugs – Details

1. Chloroquine

- **Definition:** 4-aminoquinoline blood schizontocide.
- **Mechanism of Action:**
Concentrates in parasite's **food vacuole** → inhibits heme polymerase → toxic heme accumulates → parasite death.
- **Uses:**
 - Treatment of sensitive *P. vivax*, *P. ovale*, *P. malariae*
 - Prophylaxis in chloroquine-sensitive areas
 - Extra uses: Amoebic liver abscess, rheumatoid arthritis
- **Adverse Effects:**
 - Nausea, vomiting
 - Pruritus
 - Retinopathy (long-term use)
 - Headache

2. Quinine

- **Definition:** Alkaloid from Cinchona bark; blood schizontocide.
- **Mechanism of Action:**
Similar to chloroquine – interferes with heme metabolism in parasite.
- **Uses:**
 - Severe falciparum malaria (IV form)
 - Chloroquine-resistant cases
- **Adverse Effects:**
 - Cinchonism (tinnitus, headache, nausea, visual disturbances)
 - Hypoglycemia
 - Cardiac arrhythmias

3. Artemisinin Derivatives (Artemether, Artesunate, DHA)

- **Definition:** Sesquiterpene lactones from *Artemisia annua*.
- **Mechanism of Action:**
Produces free radicals in parasite food vacuole → damages parasite proteins.



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- **Uses:**
 - First-line for falciparum malaria (as Artemisinin Combination Therapy – ACT)
- **Adverse Effects:**
 - Nausea, dizziness
 - Rare neurotoxicity, QT prolongation

4. Primaquine

- **Definition:** 8-aminoquinoline tissue schizontocide & gametocytocide.
- **Mechanism of Action:**
Generates reactive oxygen species → damages parasite mitochondria.
- **Uses:**
 - Radical cure of *P. vivax* and *P. ovale* (eradicates hypnozoites in liver)
 - Gametocytocide for all species
- **Adverse Effects:**
 - Hemolysis in **G6PD deficiency**
 - GI upset
 - Methemoglobinemia

5. Atovaquone-Proguanil

- **Mechanism of Action:**
Atovaquone inhibits mitochondrial electron transport; Proguanil inhibits dihydrofolate reductase → synergistic action.
- **Uses:**
 - Falciparum malaria (treatment and prophylaxis)
- **Adverse Effects:**
 - Abdominal pain, headache
 - Nausea, vomiting



G. Antiamoebic Agents

Definition

Antiamoebic agents are drugs used to treat infections caused by **Entamoeba histolytica** — the protozoan responsible for **amoebiasis**.

They act on **different stages of the parasite** (trophozoite, cyst) and at different **sites of infection** (intestinal lumen, intestinal wall, liver).

Classification of Antiamoebic Drugs

1. Luminal Amoebicides (act mainly in intestinal lumen)

- Diloxanide furoate
- Iodoquinol
- Paromomycin

2. Tissue Amoebicides (act in intestinal wall & liver)

- Metronidazole
- Tinidazole
- Ornidazole
- Secnidazole

3. Mixed Amoebicides (act in both lumen and tissue)

- Metronidazole (partially)
- Tinidazole (partially)

4. Systemic Amoebicides (extraintestinal amoebiasis)

- Chloroquine
- Emetine, Dehydroemetine (used rarely due to toxicity)

1. Metronidazole

- **Definition:** A nitroimidazole derivative with tissue and partial luminal activity.
- **Mechanism of Action:**
In anaerobic organisms, its nitro group is reduced to active metabolites → bind to DNA → inhibit nucleic acid synthesis → cell death.
- **Uses:**
 - Intestinal amoebiasis (with a luminal agent)
 - Hepatic amoebiasis (liver abscess)
 - Giardiasis, trichomoniasis, anaerobic bacterial infections
- **Adverse Effects:**
 - Metallic taste
 - Nausea, vomiting



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- Disulfiram-like reaction with alcohol
- Neurotoxicity (rare)

2. Tinidazole

- **Definition:** Longer-acting nitroimidazole, similar to metronidazole.
- **Mechanism of Action:** Same as metronidazole (DNA damage in anaerobes).
- **Uses:**
 - Amoebiasis
 - Giardiasis, trichomoniasis
- **Adverse Effects:**
 - GI upset
 - Metallic taste
 - CNS effects (rare)

3. Diloxanide Furoate

- **Definition:** Luminal amoebicide used in asymptomatic intestinal infection.
- **Mechanism of Action:** Exact mechanism unknown — thought to interfere with parasite metabolism inside lumen.
- **Uses:**
 - Asymptomatic cyst carriers of *E. histolytica*
 - Combined with metronidazole in invasive disease
- **Adverse Effects:**
 - Flatulence
 - Abdominal cramps
 - Rare skin rash

4. Paromomycin

- **Definition:** Aminoglycoside antibiotic with luminal amoebicidal action.
- **Mechanism of Action:**
Inhibits protein synthesis by binding to 30S ribosome of parasite.
- **Uses:**
 - Asymptomatic intestinal infection
 - Alternative in pregnancy
- **Adverse Effects:**
 - GI upset
 - Abdominal cramps

5. Chloroquine

- **Definition:** Antimalarial drug with systemic antiamoebic action.
- **Mechanism of Action:**
Concentrates in liver → kills trophozoites in hepatic tissue.
- **Uses:**
 - Hepatic amoebiasis (with a luminal agent)
- **Adverse Effects:**
 - Nausea, headache

