



# ANTHELMINTICS

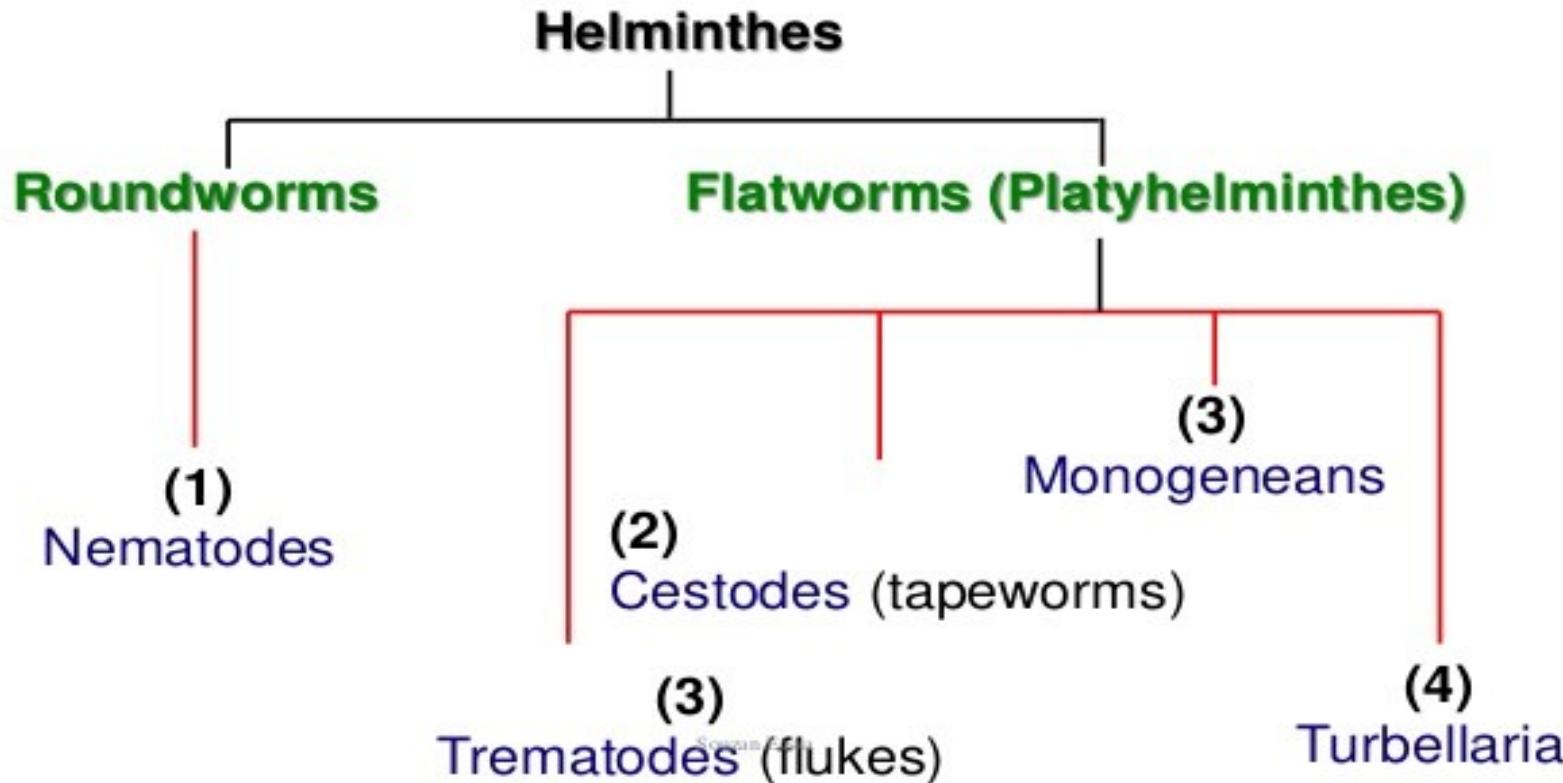
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**Lecturer of Pharmacology**  
**2020**

# ANTHELMINTICS



## Helminthes

Are eukaryotic multicellular parasites living in and feeding on living hosts, receiving nourishment and protection while disrupting their hosts' nutrient absorption, causing weakness and disease.



# ANTHELMINTICS



## 1-Benzimidazoles

### **Albendazole**

(Irregularly absorbed by oral).(albendazole sulfoxide)

### **Mebendazole**

(poorly absorbed by oral)

### **Thiabendazole**

(Rapidly absorbed by oral)

# Albendazole

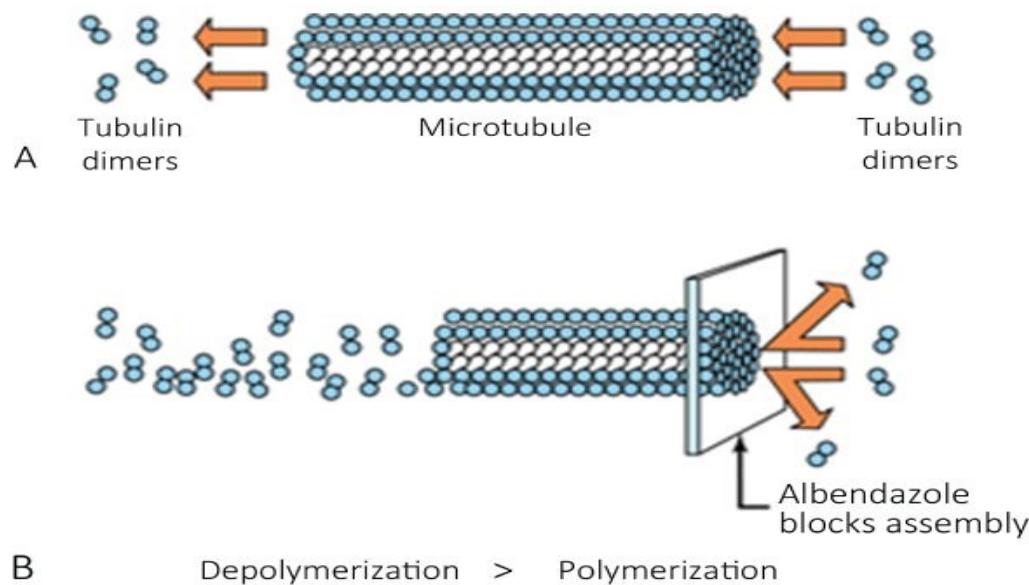


## Mechanism of action

Inhibit microtubule synthesis by binding to  $\beta$ -tubulin. immobilization & death of GIT parasites.

## Side effect of Albendazole

- 1-GIT (nusea, &diarrhea), headache, dizziness &malaise
- 2- long term liver dysfunction



# Albendazole



## Therapeutic uses

**1-Treatment of intestinal and tissue nematode**

**2-Drug of choice for treatment of cysticercosis and cystic hydatid disease**

**3-Control of lymphatic filariasis**



**Cysticercosis** is a parasitic tissue infection caused by larval cysts of the tapeworm *Taenia solium*

**Hydatid disease:** fatal, condition caused by cysts containing the larval stages of *Echinococcus granulosus*

# Thiabendazole



## Therapeutic uses of thiabendazole

- 1-Topically in cutaneous larva migrans of hookworm infections
- 2-Orally in stercoralis infection.



# 2-Diethylcarbamazine



## Mechanism of action

**It immobilizes the microfilaria by altering its surface structure and makes it more susceptible to destruction by host defense mechanisms.**

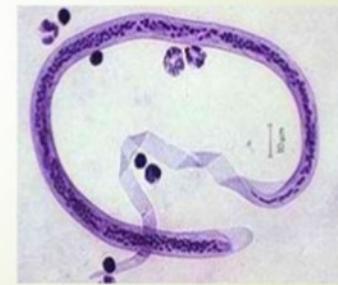


## Therapeutic uses

kills both microfilaria and adult worms of susceptible filarial species.

### Microfilariae

- The embryonic form of *Wuchereria Bancrofti* (adult worm) is known as Microfilariae.
- Present in the peripheral blood of human.



# 3-Ivermectin

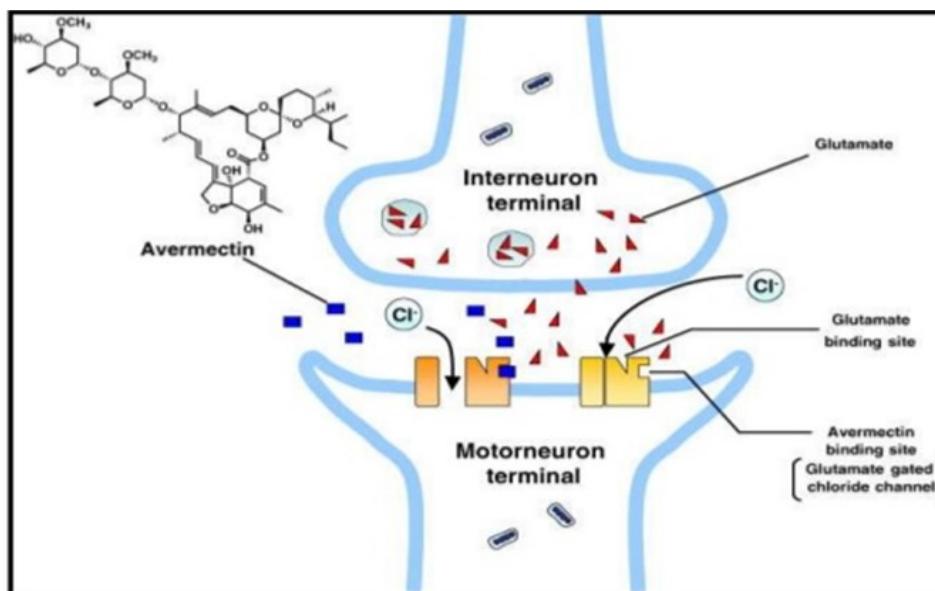


## Mechanism of action

**Tonic paralysis of nematode musculature by acting on glutamate-gated Cl<sup>-</sup> channels.**  
**It does not kill adult worms but blocks release of microfilariae for some months after therapy.**

## Therapeutic uses

- 1-Antifilarial drug (curative with single oral dose)**
- 2-Drug of choice in treatment of intestinal strongyloidiasis.**



# 4-Niclosamide



## Mechanism of action

Inhibition of oxidative phosphorylation of the parasite  
deterioration

## Therapeutic uses

A second choice to praziquantel to treat cestode.

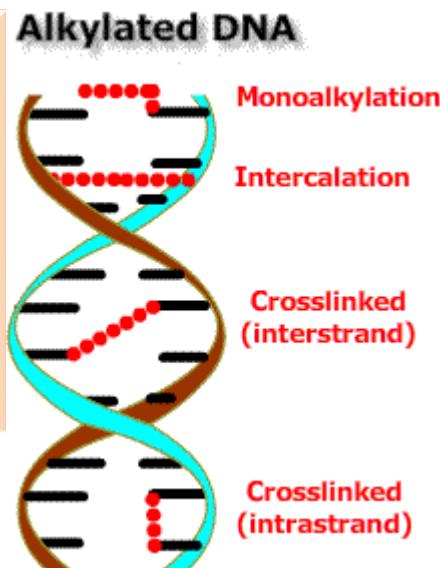


# 5-Oxamniquine

## Mechanism of action

alkylating DNA.  
It induces shift of worm from mesentery to liver

→ Death



## Therapeutic uses

Second choice drug to praziquantel in treatment of schistosoma mansoni.

# 6-Piperazine



## Mechanism of action

GABA agonist → increases chloride conductance & produces hyperpolarization of ascaris leads to flaccid paralysis

## Therapeutic uses

Highly effective against ascaris and enterobius.  
Contraindicated: epilepsy, pregnancy, impaired renal or hepatic function

# 7-Pyrantel pamoate

## Mechanism of action

A neuromuscular blocking agent → release of acetylcholine & inhibition of cholinesterase  
→ spastic paralysis

## Therapeutic uses

an alternative to mebendazole in the treatment of →  
1-Ascaris-Enterobius-Hookworm infections.

# 8-Praziquantel

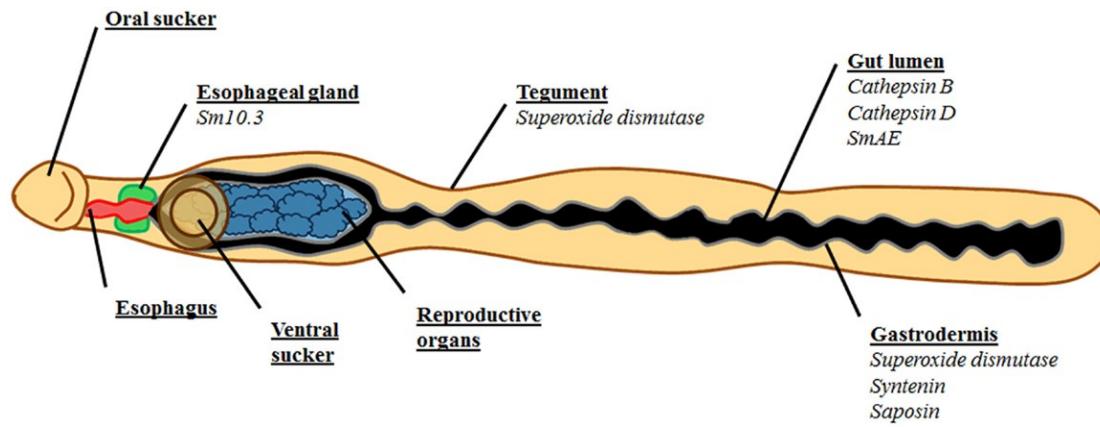


## Mechanism of action

increases the influx of  $\text{Ca}^{++}$  across tegument of schistosomes → contraction followed by paralysis of worm.

## Therapeutic uses

- 1-All species of schistosoma.
- 2-Most other trematode and cestode infections.



# Antiviral drugs



# Antiviral drugs



**Understanding Viruses  
They are different from other Microbes**

## Viral replication

- A virus cannot replicate on its own
- It must attach to and enter a host cell
- It then uses the host cell's energy to synthesize protein, DNA, and RNA

# Antiviral drugs



## Understanding Viruses

**Viruses are difficult to kill because they live inside the cells**

- Any drug that kills a virus may also kill cells

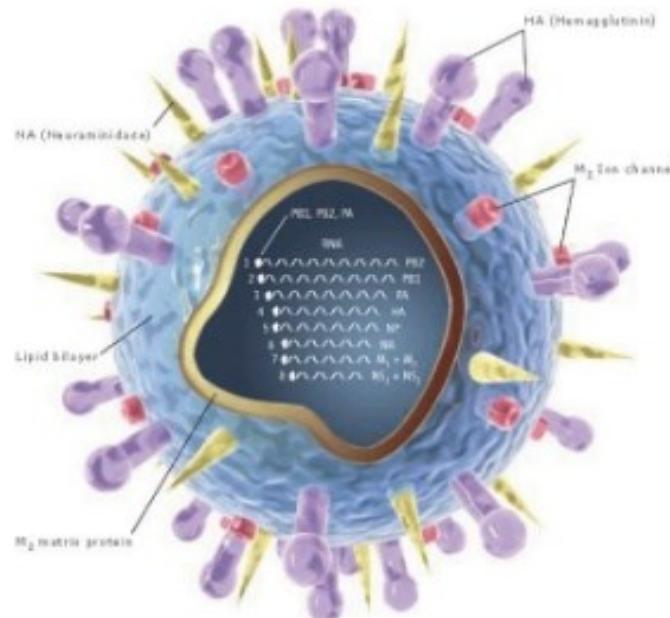


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# Antiviral drugs



- Viral multiplication often takes place before symptoms occur → given before onset of disease (chemoprophylaxis).
- Viruses are capable of developing resistance to antiviral drugs.



So mulitherapy is recommended

# Classification of antiviral drugs



## I) Drugs that directly impair virus replication:

- 1- Herpes viruses (acyclovir, vidarabine, idoxuridine).
- 2- HIV (zidovudine).
- 3- CMV (ganciclovir,foscarnet).
- 4- RSV (ribavirin).
- 5- Influenza virus (amantadine).

## II) Drugs that modulate the host immune system:

e.g. alpha-interferon.

# Herpes viruses (herpes simplex and herpes zoster).



## Acyclovir

### Mechanism of action

A synthetic purine analog, inhibits viral replication by inhibiting viral DNA polymerase → inhibition of DNA synthesis.

### Therapeutic uses

- 1) Herpes simplex virus (mucocutaneous, genital herpes, herpes simplex keratitis and encephalitis)
- 2) Herpes zoster especially in immunocompromized patients.

# Acyclovir



## Side effects

- 1-**Topically**→ local irritation and a transient burning when applied to genital lesions.
- 2-**Orally**→ nausea, vomiting and headache may occur.
- 3-**I.V**→ local phlebitis, rash, nephrotoxicity, and encephalopathy.

# Herpes virus



## Vidarabine

Like acyclovir in mechanism and uses but acyclovir is superior



## Valacyclovir

Prodrug that converted to acyclovir used also in herpes simplex &zoster

## Iodoxuridine

Thymidine analogue (used topically in herpes simplex keratitis).

# HIV



**Depletes CD4 lymphocytes leading to cellular immunodeficiency.**  
**HIV replicates by converting its single stranded RNA into double stranded DNA which is incorporated into host DNA by enzyme reverse transcriptase which is unique to retroviruses.**



# Zidovudine



## Mechanism of action

a synthetic thymidine analog that inhibit viral reverse transcriptase. This terminates synthesis of DNA



## Therapeutic uses

- 1-Decrease rate of progression & prolong survival of patients with AIDS.
- 2-Prevent prenatal transmission of virus in pregnant with HIV infection.

# Zidovudine



## Side effects

- 1-Bone marrow depression with anemia, granulocytopenia, thrombocytopenia.
- 2-Headache, restlessness, agitation, insomnia.

**Abacavir** used in HIV infection with high effective role and high oral bioavailability but cause hypersensitivity reactions

# CMV



## Ganciclovir and Valganciclovir

### Therapeutic uses

1-CMV retinitis in AIDS patients

2-Prevent CMV disease if given before organ transplantation.

**Ganiciclovir** similar to acyclovir in action. Valganciclovir is prodrug

**Foscarnet** used in CMV but cause renal toxicity

**Cidofovir** similar to ganciclovir & foscarnet . Use in anogenital warts



## Ribavirin

### Mechanism of action

Synthetic purine analog, inhibits replication of influenza A, influenza B and respiratory syncytial virus by inhibiting viral RNA polymerase

### Therapeutic uses

1- Ribavirin aerosols sprayed in RSV bronchiolitis and pneumonia in hospitalized children and for treatment of severe influenza virus infection.

2-Oral ribavirin in combination with injected interferon for treatment of chronic hepatitis C.

**Side effects:** Conjunctival irritation, rash, transient wheezing

# Influenza virus



## Amantadine

### Mechanism of action

Both amantadine and rimantadine inhibit virus replication

### Side effects

1-GIT (loss of appetite)  
2-CNS (insomnia, nervousness, confusion, hallucinations & Seizures )

### Therapeutic uses

- 1-Prophylactically to prevent infection with influenza A virus.
- 2- uncomplicated influenza
- 3-parkinsonism.

**Zanamivir and oseltamivir used in** prevention and treatment of acute influenza.

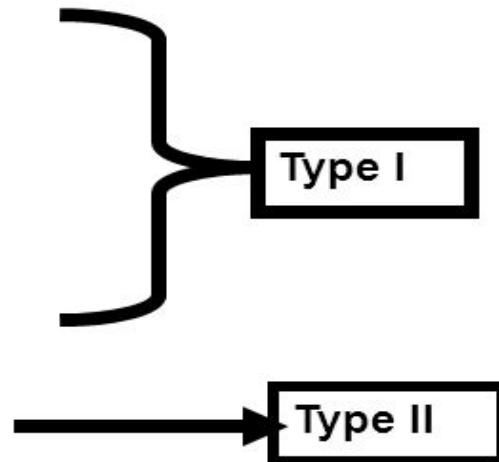
# Interferon



## Types of interferon

### According to pharmacological structure

1. Alpha (leukocyte interferon)
  - By virus infected leukocytes
2. Beta (fibroblast interferon)
  - By virus infected fibroblasts or epithelial cells
3. Gamma (immune interferon)
  - By activated T cells & NK cells



### According to origin

1. Natural human interferon
2. Synthetic pegylated interferon

# Mechanism of action



**Interferons are protective glycoproteins that possess complex antiviral, antineoplastic and immuno-regulatory properties.**

**1-Following binding to specific cellular receptors, IFNs stimulate the transcription of specific genes, leading to synthesis of >20 proteins that contribute to viral resistance at different stages of viral infection.**

**2-Modify immune response (induce expression of MHC antigens**  
**lysis of cytotoxic T-lymphocytes.**

**3-Inhibit neoplastic growth & modify cell regulatory mechanism.**

# Side effects



- 1-Influenza-like illness manifested by fever, chills, headache, myalgia, nausea, vomiting and diarrhea.
- 2-Myelosuppression (granulocytopenia, thrombocytopenia, leukopenia) & neurotoxicity
- 3-With prolonged use neurasthenia, fatigue, anorexia, weight loss and myalgia may occur.

# Therapeutic uses



- 1-Chronic hepatitis C and B.
- 2-Condygomata accuminata (genital warts) caused by HPV
- 3-CMV infections and herpes zoster virus infections in immunosuppressed patients.
- 4-In some types of cancer (hairy cell leukemia, Kaposi's sarcoma in AIDS, multiple myeloma and non-Hodgkin's lymphomas).

**NB:** Purified interferon are now available & produced by recombinant DNA technology.

many  
thanks!

