

# Immunopharmacology.

## \* Immunomodulators :

These are the sub. that are used to modify the immune response.

### 2 Types of Immunomodulators

Immunosuppressants



These are the agent that suppress the immune system.

Immunostimulants



These are the agent that stimulate the immune system.

## → Immunosuppressants :

They suppress the immune system.

### Classification :

1. Calcineurin Inhibitors (specific T-cell inhibitor)  
eg., Cyclosporine  
Tacrolimus
2. Corticosteroids  
eg., Prednisone  
Methyl Prednisone  
Dexamethasone.
3. Antibodies  
eg., Muromonab } Monoclonal antibodies  
Basiliximab }
4. cytotoxic drug  
a. Alkylating agent :  
eg., cyclophosphamide, chlorambucil.

b. antimetabolites

eg., Azathiopurine

Methotrexate

5. Miscellaneous

eg., Interferons

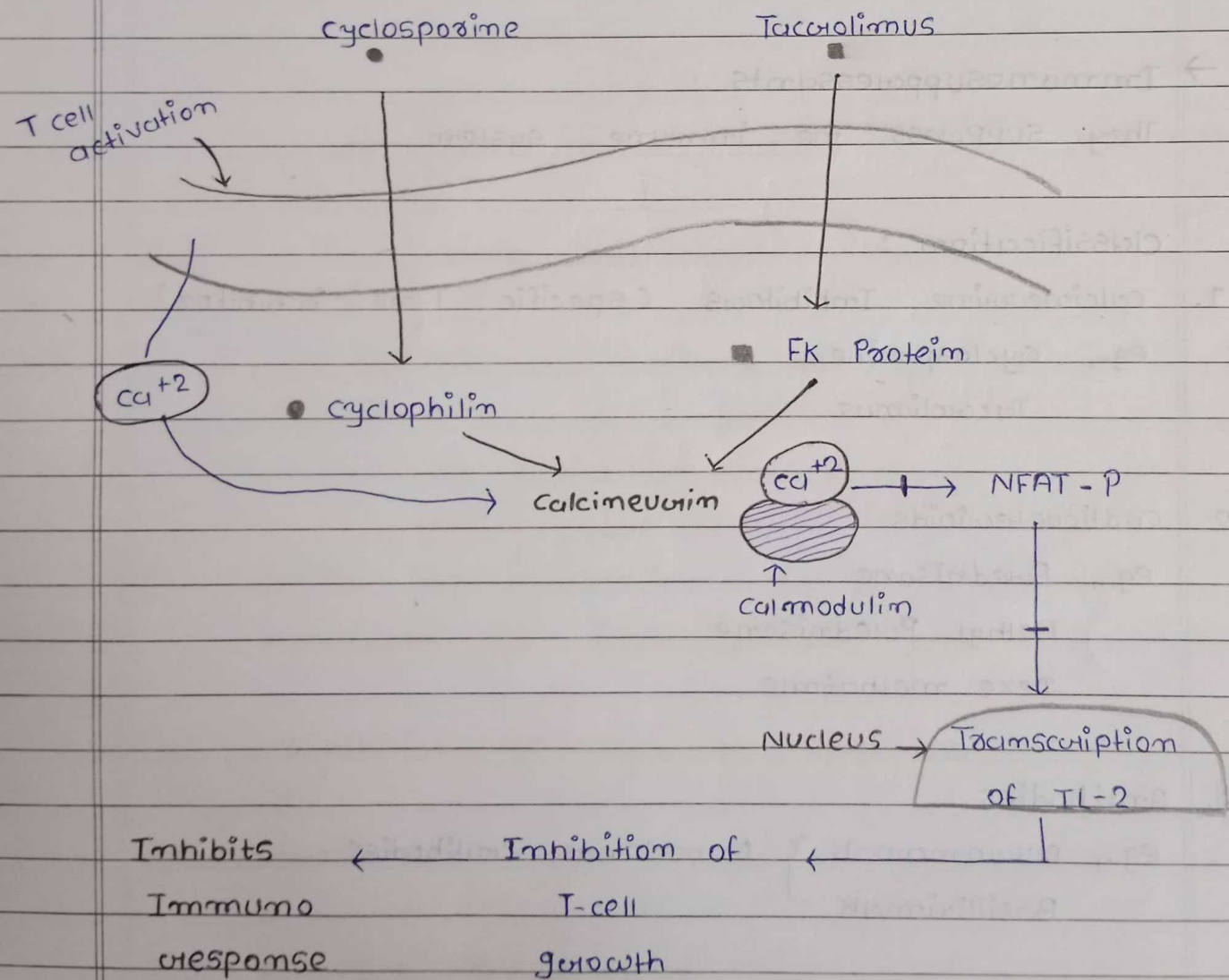
[FK] → Fructose kinase binding

\* Calcineurin Inhibitors : [IL] → Interleukins Protein

→ Cyclosporine and Tacrolimus [NFAT] → Nuclear Factor for

activated T-cell

MOA :



Normally when a T-cell is activated its cytoplasmic  $Ca^{+2}$  is complexed with calmodulin.



Stimulates phosphatase enzyme [calcineurin]



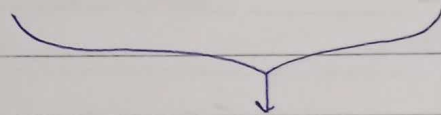
causes dephosphorylation NFAT is active.



enters into nucleus to enhance the IL-2 transcription

binds to  
cyclophilin

binds to  
FK Protein.



combinedly called Immunosuppressants (Receptor)



Drug - Immunosuppressant complex.



Inhibit calcineurin activity.



Blocks the activation of T-cell



Inhibits the production of IL-2 which is necessary for T-cell growth and differentiation.



Inhibition of Immune Response

Pharmacokinetics : Route → oral or Intravenous.

side effects : Nephrotoxicity

Hepatotoxicity

Hypertension



## \* Immunostimulants :

- These are the agent that stimulate the immune system

### → classification :

#### 1. Immunization Vaccines

- i. BCG (Bacillus calmette guerin)
- ii. VZV (Varicella zoster vaccine)
- iii. Yellow fever vaccine
- iv. Rotavirus vaccine

#### 2. Recombinant cytokines

- i. Interleukins
- ii. Interferons
- iii. Colony-stimulating factors

#### 3. Others

Levamisole

### → Bacterial Vaccines :

BCG (Bacillus calmette guerin)

- It is live bacterial vaccine

↓

developed in 1921 by calmette and guerin in France

↓

Hence it is termed as "Bacillus - calmette guerin" vaccine

NK-cell  
Natural  
Killer cell

- BCG vaccine involved in stimulation of immune system
- Its action is non-specific and stimulates T-cells and NK cells
- It is used for treatment of urinary bladder cancer.
- 0.1 ml dose by intracutaneous (0.05 ml in neonate)

Normally when a T-cell is activated its cytoplasmic  $Ca^{+2}$  complexed with calmodulin.



stimulates phosphate enzyme. [calcineurin]



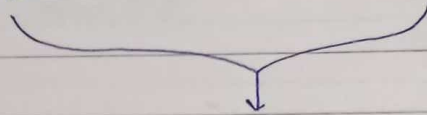
cause dephosphorylation NFAT is active.



enters into nucleus to enhance the IL-2 transcription.

binds to  
cyclophilin

binds to  
FK Protein.



combinedly called Immunophilins (Receptor)



Drug - Immunophilin complex.



Inhibit calcineurin activity.



Blocks the activation of T-cell



Inhibits the production of IL-2 which is necessary for T-cell growth and differentiation



Inhibition of Immune Response

Pharmacokinetics : Route → oral or Intravenous.

side effects : Nephrotoxicity

Hepatotoxicity

Hypertension

- In adult and children tuberculin testing is done before hand and BCG given only to negative response.
- A Red painless papules appears after 7-10 days reach about 8 mm diameter in 5 weeks with swelling of axillary lymph node. Heals in 3 months and Totally Heals in 6-months
- contraindicated in HIV Positive Person  
During Pregnancy
- side effect : Hypersensitivity reaction  
Fever  
Malaise.

#### → Recombinant Interferons :

- These are proteins that are produced by cells of immune system.
- 3 type : Alpha, Beta, gamma.
- Interferon's direct the immune system's attack on virus, bacteria, tumours.
- IFN- $\alpha$  :
  - Human recombinant IFN- $\alpha$  acts as a immunostimulant
  - It activates T-lymphocytes, NK cells and macrophages.
  - IFN- $\alpha$  and IFN- $\alpha$ 2b are indicated for variety of cancers.
  - It is used in treatment of Hepatitis - B and C injections

- Side effect : Flu, nervousness  
Confusion, Nephrotoxicity

#### → IFN $\beta$ 1a and $\beta$ 1b

Used for treatment of relapsing type multiple sclerosis  
SE : Injection site local reaction



→ IFN- $\gamma$

used in chronic immunosuppressive granulomatous disease

side effect : GIT stress , skin rashes

→ Immunoglobulins :

- Also known as antibody

- Immunoglobulins are immune system related protein

Found in the serum fraction of blood tissue fluids and

some secretions

- Types of Immunoglobulin

Ig E , Ig A

Ig M , Ig D

Ig G