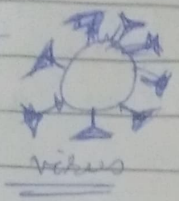
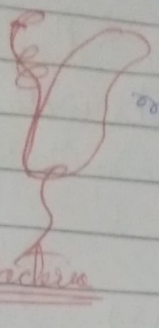
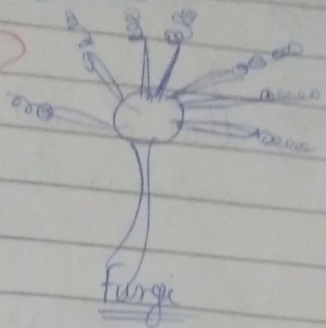
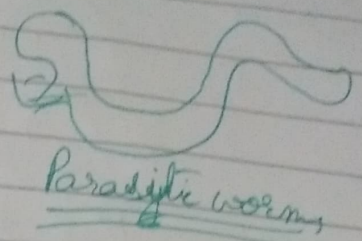
Immune Response System :-

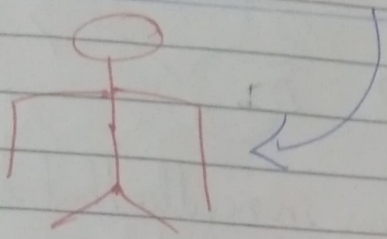
Pathogens :-



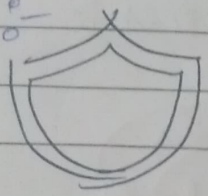






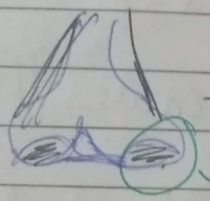


1st line of defence :-



→ External protection :- Skin

It is the 1st line of defence against letting these pathogens enter the body

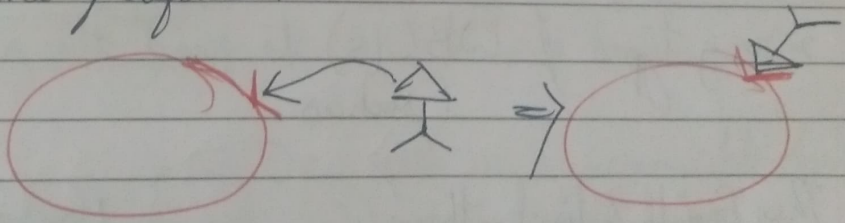


→ Mucous membrane is also a 1st line of defence.

→ inner lining of nose

This 1st line of defence is non-specific because it is not selective about what it blocks from getting into body.

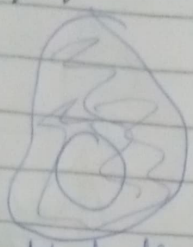
Now, pathogens like viruses can breach through this first line of defence.



Virus are like "keys to locks" that allows them to fool the victim cell

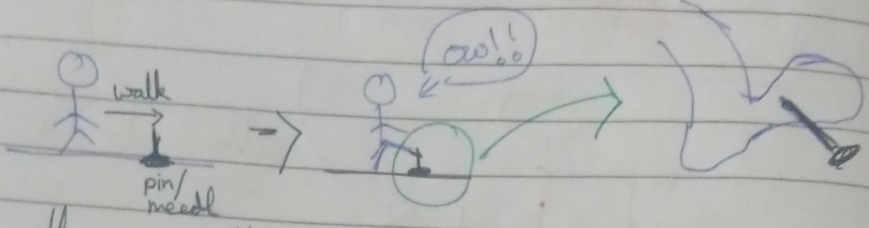
→ Leading to Infected cell

2nd line of defence :- If few pathogens do get past the 1st line of defence,

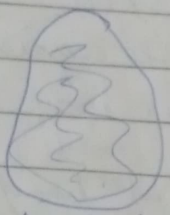


Mast cell

⇒ Part of 2nd line of defence that assists with allergic and inflammatory responses



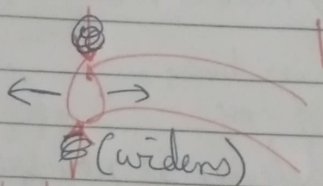
When there is pathogens in needle that enters directly, getting past the 1st line of defence, then :-



Mast cell

triggered to release → Histamine

Causes the blood vessels to dialate (widens)

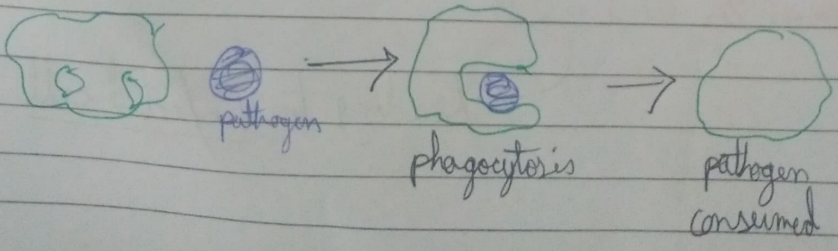


(widens)

This means the blood vessels will widen near the injury

They also make the blood vessels leakier to allow many types of WBC(s) to reach the area (such as Macrophages)

They Engulf & digest pathogens



3rd line of defence :- But what if we need a more targeted response

This is where Adaptive Immunity comes into play.

In Adaptive Immunity :-

Antigen is something that the body recognises as non-self

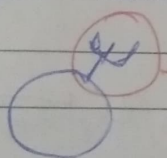
↓ It is something part of the pathogen

∴ This Adaptive Immunity → 3rd line of defence

Cell-Mediated | Humoral

1) Cell-Mediated :- Tcells are responsible for defending against intracellar ~~pathogens~~ pathogens.

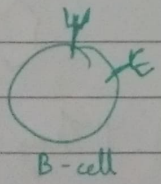
Here, Cytotoxin T-Cells directly kill infected cells
Helper T-cells activate and regulate other immune cells (Cytotoxin T-Cells, B cells etc)



→ Tcell receptors recognise and bind to specific antigen presented with MHC complexes

MHC are proteins found on the surfaces of cells that help the immune system recognise foreign substances.

2) Humoral (Antibody-mediated) :- B cells are responsible for producing antibodies that target extracellular pathogens



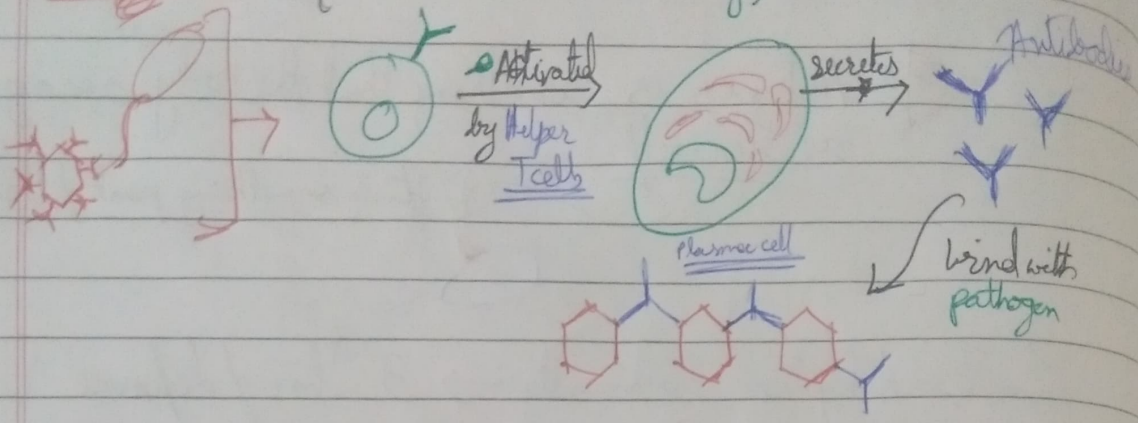
B cell can be activated two ways :-
1) Help from Helper Tcell → memory B cells generated
2) No Help from Helper Tcell → no memory formation

Tcell dependent activation leads to stronger immune response & memory
Tcell independent activation leads to faster but less specific immune response

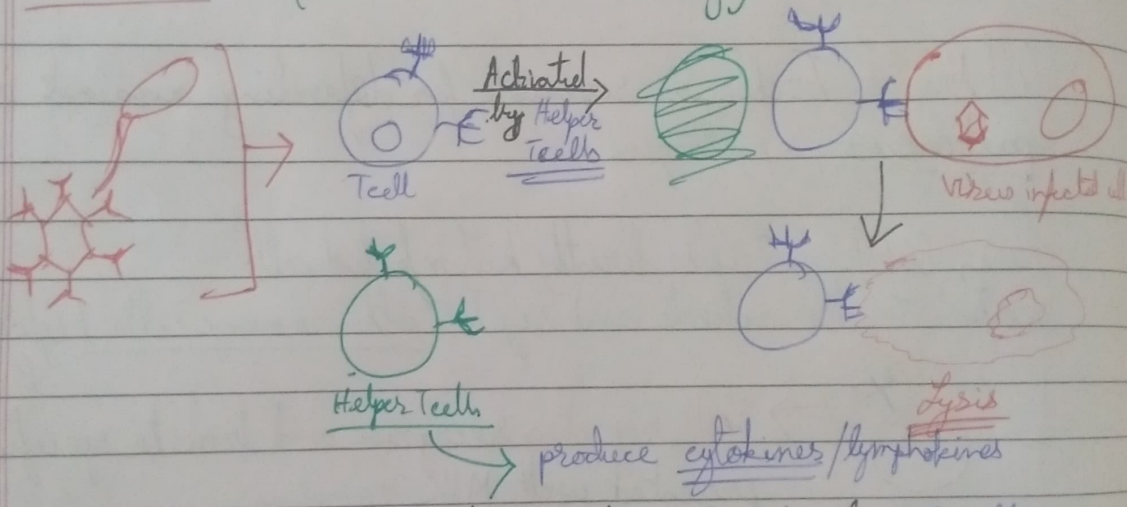
Memory cells :-

These cells stores memory of pathogens

For B cells :- (For Humoral Immunity)



For T-cell :- (For Cellular Immunity)



Cytokine secretion by helper T-cells help activate T-cells, making them more effective in eliminating infected cells.

Memory cell generation :-