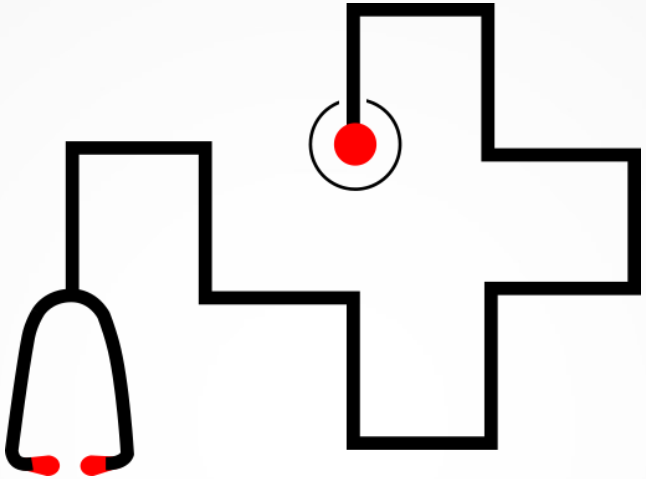
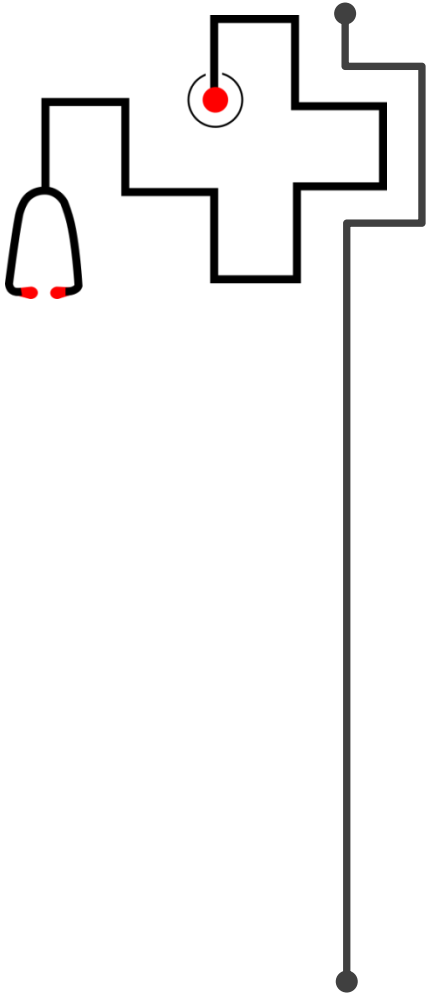


MATERI 2 (FA 1604)

KOMPONEN SISTEM IMUN

Disusun oleh :
Umi Baroroh, S.Si., M.Biotek.
Sekolah Tinggi Farmasi Indonesia



POKOK BAHASAN

01 ANTIGEN DAN IMUNOGEN

02 *MAJOR HISTOCOMPATIBILITY COMPLEX*

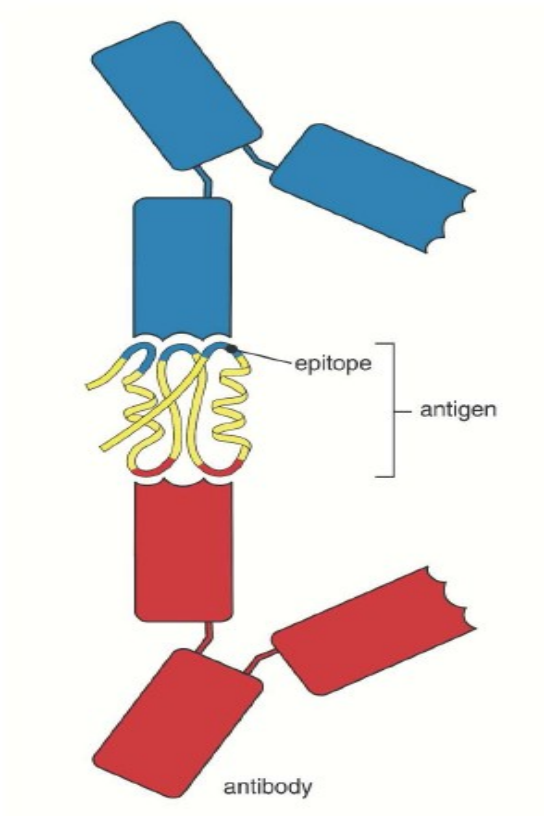
03 *ANTIGEN PRESENTING CELL*

04 SEL LIMFOSIT

05 ORGAN LIMFOID

06 RESEPTOR

ANTIGEN DAN IMUNOGEN



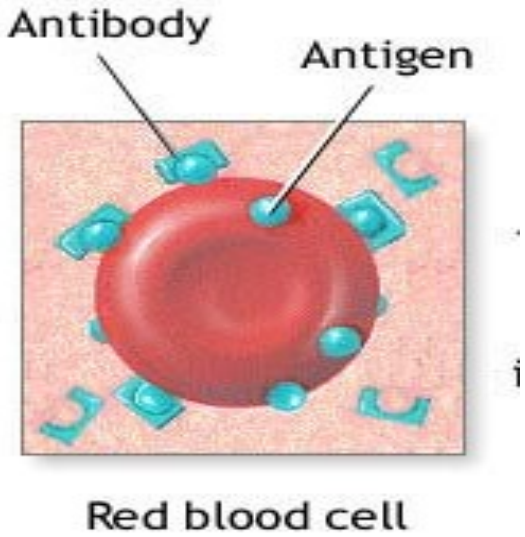
Imunogen → Substansi yang dapat menginduksi respon imun.

Antigen → Molekul yang dikenali oleh respon imun (imunoglobulin, reseptor sel B, reseptor sel T) ketika membentuk kompleks dengan MHC.

Epitop (antigen determinan) → Bagian antigen, tempat berikatannya reseptor.

Hapten → molekul kecil, bersifat antigenik tetapi tidak mampu menginduksi respon imun spesifik.

Antigens



- Antibody generating
- Foreign molecule stimulates production of antibodies

IMUNOGENISITAS

Kemampuan untuk menginduksi respon imun humoral dan atau yang di mediasi oleh sel.

B cells + **immunogen** → effector B cells + memory B cells

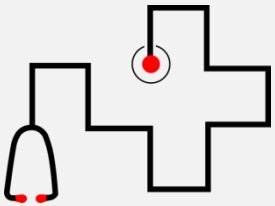
↓

(plasma cells) → **antibody**

T cells + **immunogen** → effector T cells + memory T cells

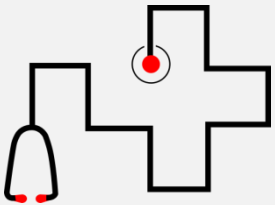
↓

(e.g., CTLs, T_Hs)



FAKTOR YANG MEMPENGARUHI IMUNOGENISITAS

1. KEASINGAN, kemampuan membedakan *self* dan *non-self*
2. UKURAN MOLEKUL, BM>100.000 Da (makromolekul)
3. STRUKTUR KIMIA, semakin kompleks semakin tinggi
4. KONSTITUSI GENETIK, susunan genetik individu
5. METODE PEMASUKAN ANTIGEN
6. DOSIS, makin tinggi dosis respon imun meningkat secara sebanding



JENIS IMUNOGEN

a) **Protein** → imunogenik, umumnya multideterminan univalent

b) **Polisakarida** → umumnya imunogenik. Glikoprotein dapat menimbulkan respon imun terutama pembentukan antibodi.

c) **Lipid** → tidak imunogenik, imunogenik jika berikatan dengan protein atau polisakarida. Biasanya dianggap sebagai hapten.

d) **Asam nukleat** → tidak imunogenik, imunogenik jika berikatan dengan protein atau polisakarida.

PENGELOMPOKAN ANTIGEN

ENDOGEN

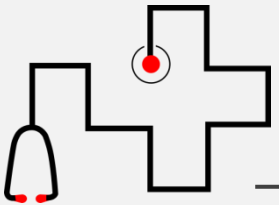
Antigen yang berasal dari dalam tubuh sendiri.

- ***xenogenic/heterolog***, spesies yang berlainan.
- ***autolog/idiotipik***, komponen tubuh sendiri.
- ***allogenic./homolog,*** membedakan satu individu dengan individu lain dalam satu spesies (eritrosit, leukosit, trombosit, MHC)

EKSOGEN

Antigen yang berasal dari luar tubuh individu.

Contoh: berbagai bakteri, virus, dan obat-obatan



Antigen Berdasarkan Epitop

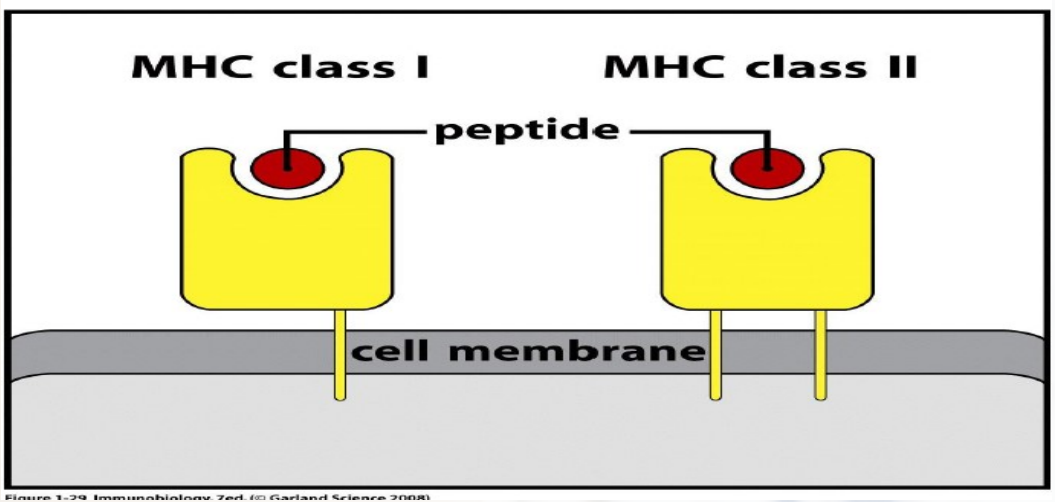
Unideterminan, univalent
Hanya satu jenis determinan (epitop) pada satu molekul.
Contoh : hapten

Unideterminan, multivalent
Hanya satu jenis determinan saja, tetapi dua atau lebih determi nan tersebut ditemukan pada satu molekul.
Contoh : Polisakarida

Multideterminan, univalent
Banyak epitop, tetapi hanya satu dari setiap macamnya.
Contoh : Protein

Multideterminan, multivalent
Banyak jenis determinan dan banyak dari setiap jenisnya pada satu molekul (antigen dengan BM yang tinggi dan kompleks secara kimiawi)
Contoh : Kimia kompleks

MAJOR HISTOCOMPATIBILITY COMPLEX



Molekul yang dapat berikatan dengan fragmen peptida dan mengantarkannya ke permuka an sel sehingga dapat dikenali oleh reseptor.

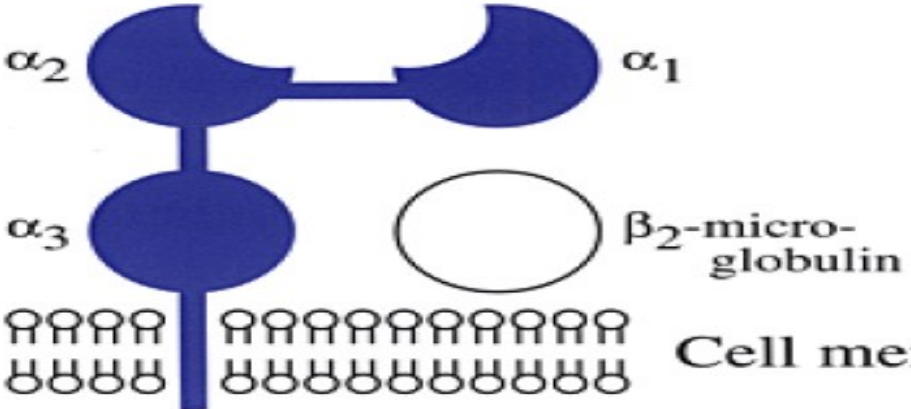
Major Histocompatibility Complex (MHC)

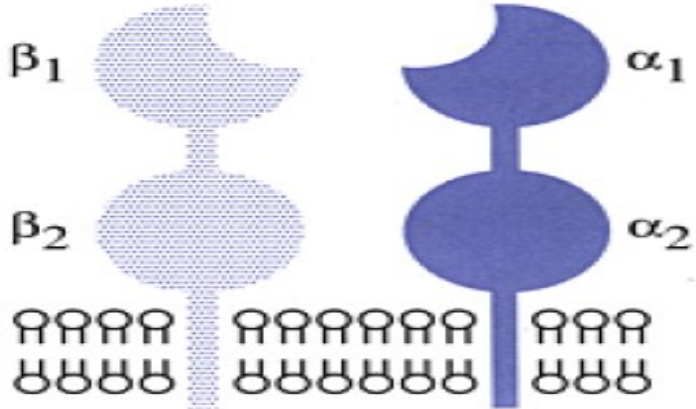
MHC I

•Mengikat peptida dari protein yang disintesis di sitoplasma
• Ada di permukaan semua sel berinti
•Dikenali oleh co-reseptor CD8 sel T

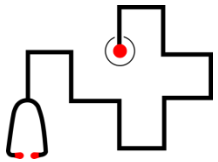
MHC II

•Mengikat peptida dari protein dalam vesikel intrasel
• Ada di permukaan APC
•Dikenali oleh co-reseptor CD4 sel T

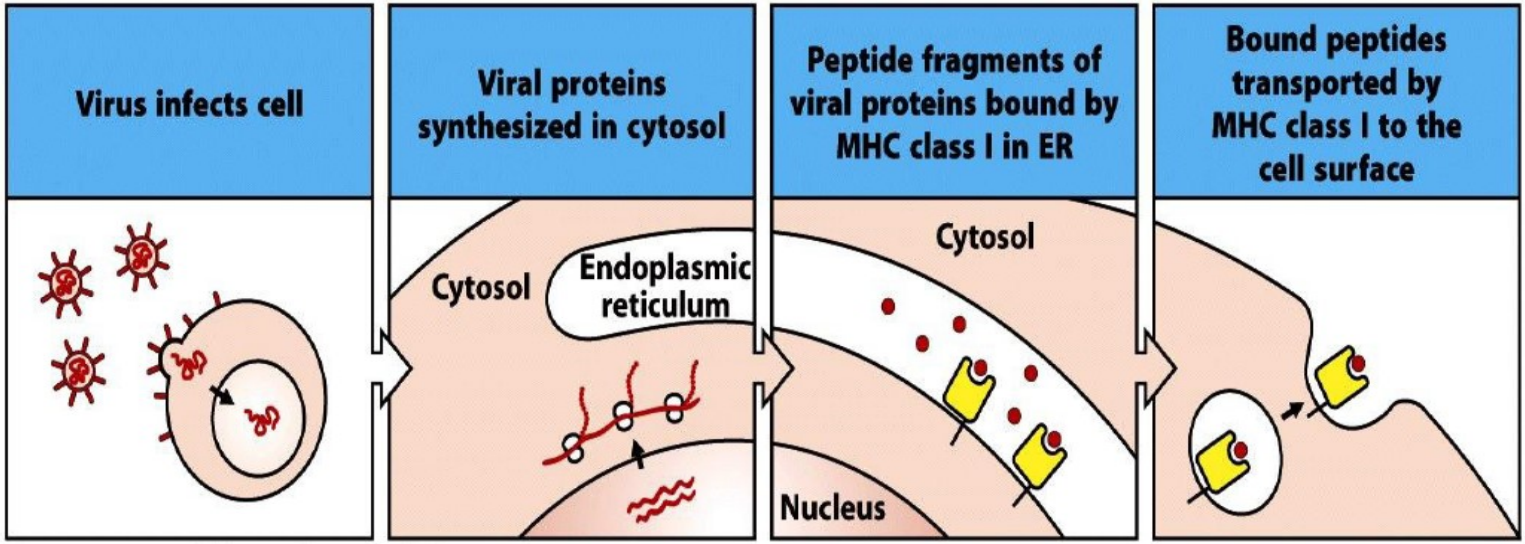




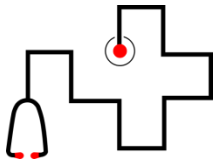
Cell membrane



MHC I



Virus menginfeksi sel → materi genetik virus terintegrasi pada DNA inti sel → Sintesis protein virus → Fragmen peptida virus yang ditampung di RE berikatan dengan MHC I → kompleks antigen-MHC I ditransportasikan ke permukaan sel



MHC II

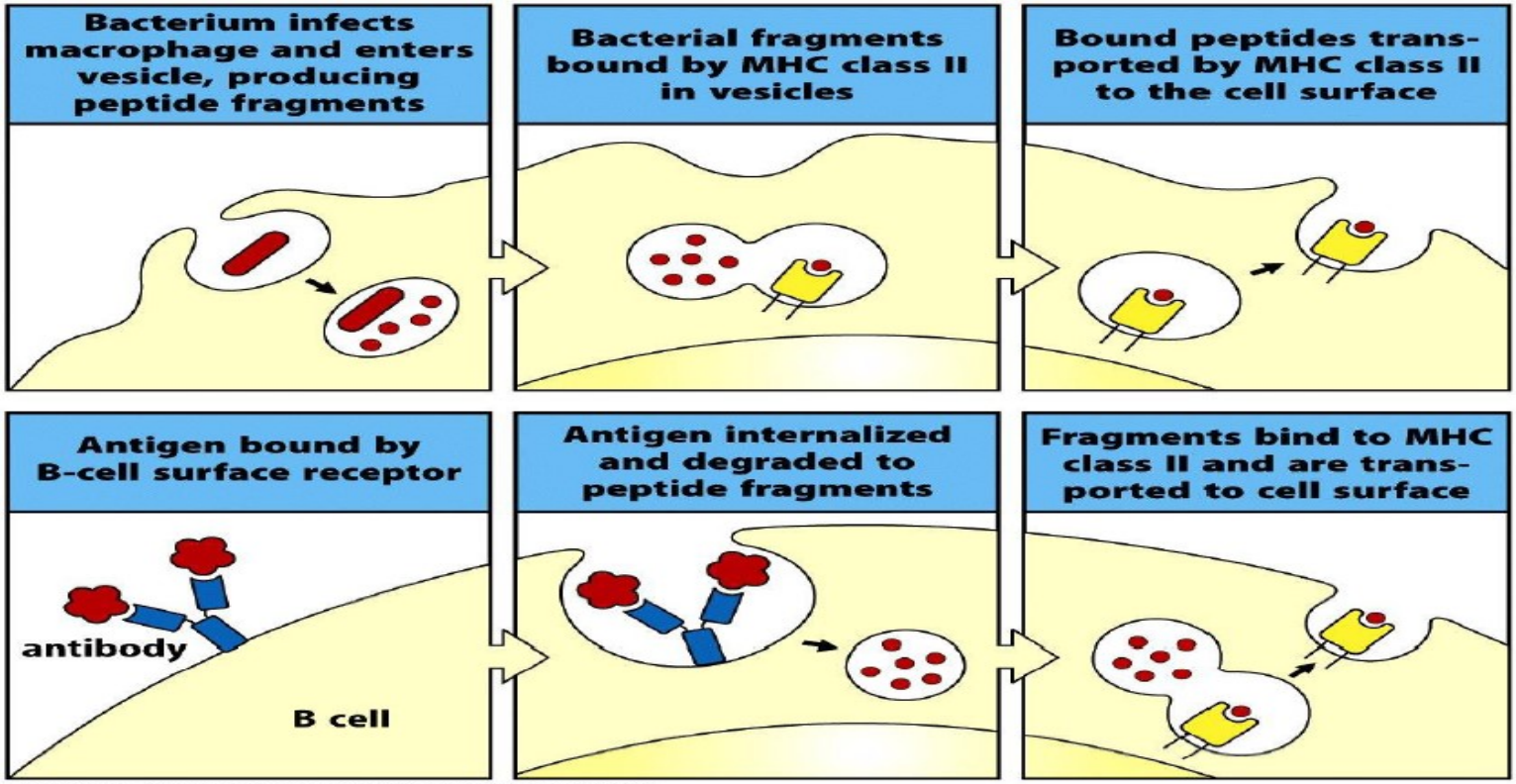
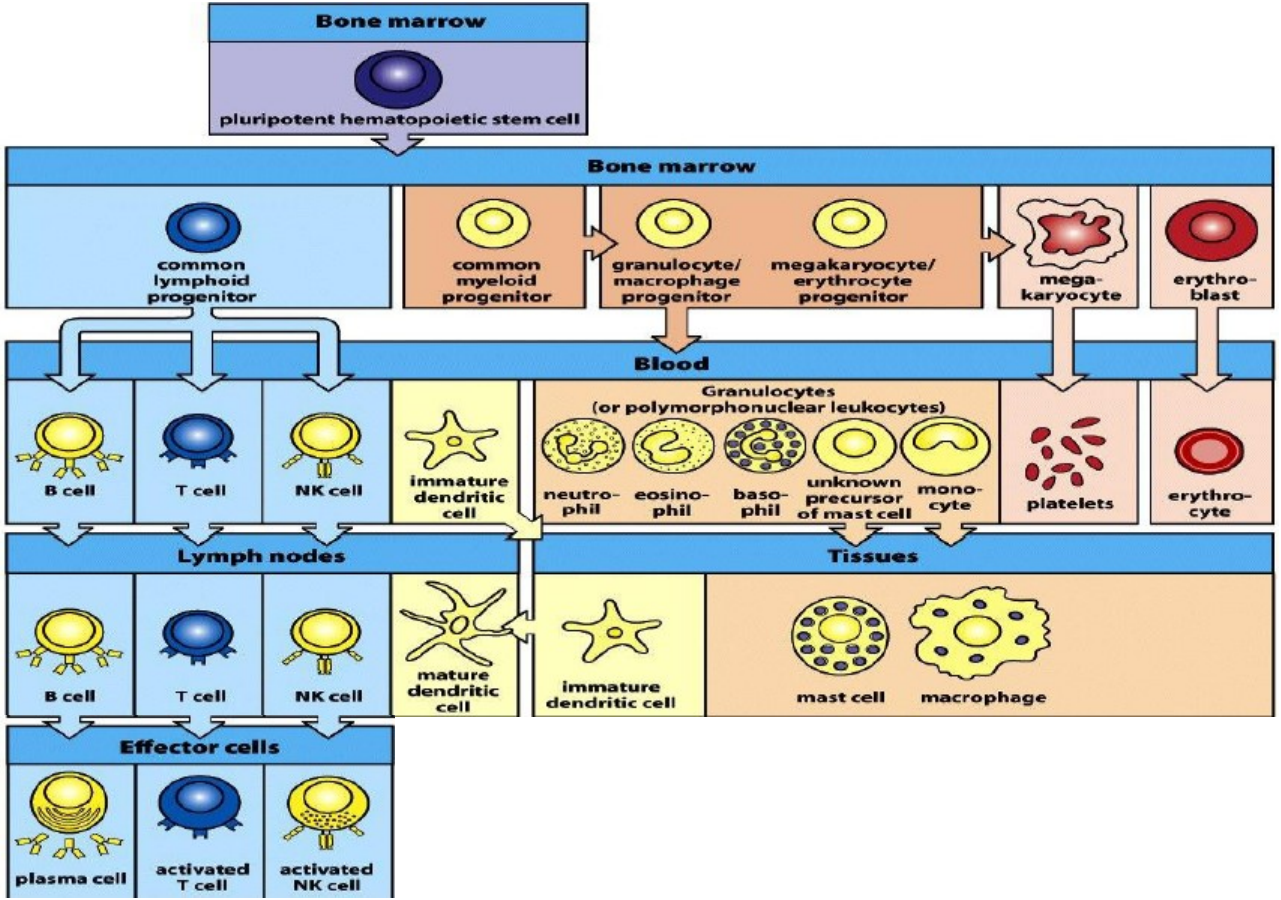


Figure 1-31 Immunobiology, 7ed. (© Garland Science 2008)

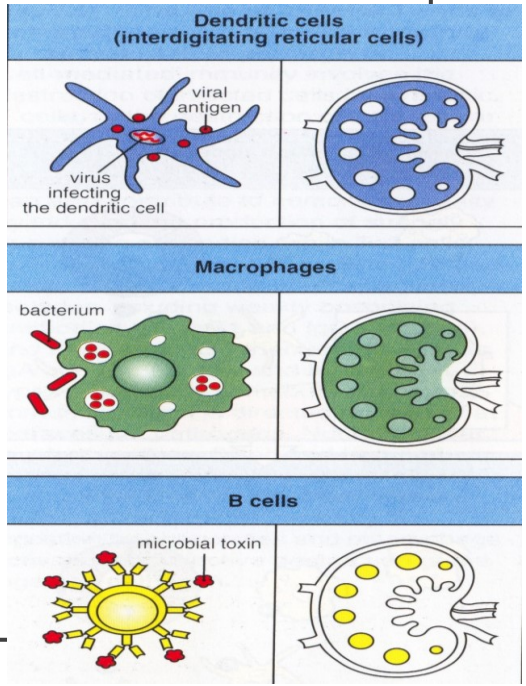
SEL-SEL IMUN


Bone marrow
pluripotent hematopoietic stem cell
Bone marrow
common lymphoid progenitor
common myeloid progenitor
granulocyte/ macrophage progenitor
megakaryocyte/ erythrocyte progenitor
mega-karyocyte
erythro-blast
Blood
B cell
T cell
NK cell
immature dendritic cell
Granulocytes (or polymorphonuclear leukocytes)
neutro-phil
eosino-phil
baso-phil
unknown precursor of mast cell
mono-cyte
platelets
erythro-cyte
Lymph nodes
Tissues
B cell
T cell
NK cell
mature dendritic cell
immature dendritic cell
mast cell
macrophage
Effector cells
plasma cell
activated T cell
activated NK cell

ANTIGEN PRESENTING CELL (APC)

Sel yang secara khusus dapat menangkap mikroba dan antigen lain serta mempresentasikannya ke limfosit sehingga mampu menstimulasi proliferasi dan diferensiasi limfosit tersebut.

- Sel Dendritik → APC paling efektif, secara konstitutif mengekpresikan MHC II dan aktivitas ko-stimulatori dalam jumlah tinggi, dapat menstimulasi sel B dan sel T_h naif.
- Makrofaga → sinyal aktivasi fagositosis untuk mengekspresikan molekul MHC II dan ko-stimulatori.
- Sel B → konstitutif mengekpresikan MHC II dan ko-stimulatori yang distimulasi sinyal diferensiasi antigen-spesifik dari sel T, sehingga menghasilkan antibodi spesifik

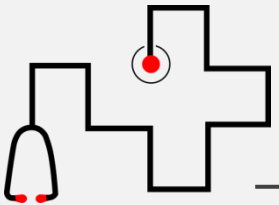


ANTIGEN PRESENTING CELL (APC)

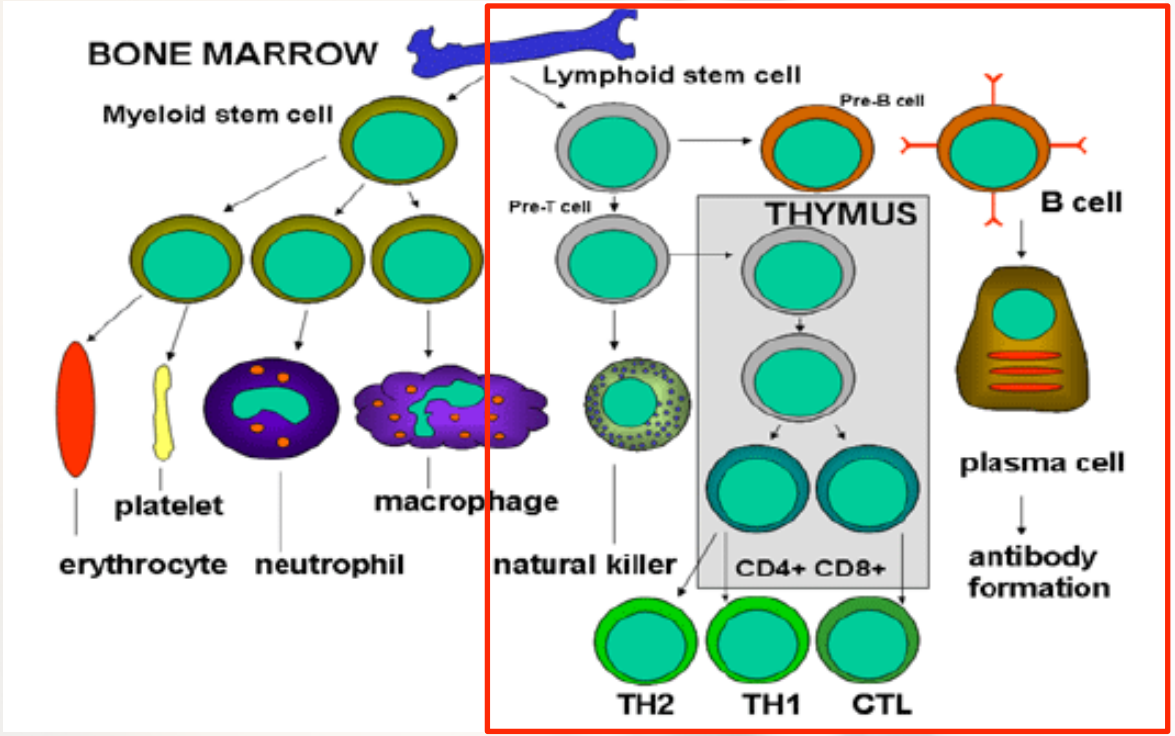
- Profesional : memiliki mekanisme uptake antigen yang berbeda dari sel lainnya, secara konstitutif mengekpresikan molekul MHC kelas II dan aktivasi ko-stimulatori.
- Non-profesional : harus diinduksi untuk mengekspresikan molekul MHC kelas II atau sinyal ko-stimulatori. Berfungsi dalam jangka waktu pendek, biasanya sebagai respon inflamasi.

TABLE 8-1 Antigen-presenting cells

Professional antigen-presenting cells	Nonprofessional antigen-presenting cells	
Dendritic cells (several types)	Fibroblasts (skin)	Thymic epithelial cells
Macrophages	Glial cells (brain)	Thyroid epithelial cells
B cells	Pancreatic beta cells	Vascular endothelial cells



SEL LIMFOSIT



LIMFOSIT T

- Proses pematangan di Timus
- Berfungsi sebagai efektor dan regulator.
- CD8 ($T_{supressor}$ dan $T_{cytotoxic}$)
- CD4 (T_{helper})

LIMFOSIT B

- Proses pematangan di *Bone marrow*
- Berfungsi dalam pembentukan antibodi
- Antigen permukaan (sIg)
- Sel B memori

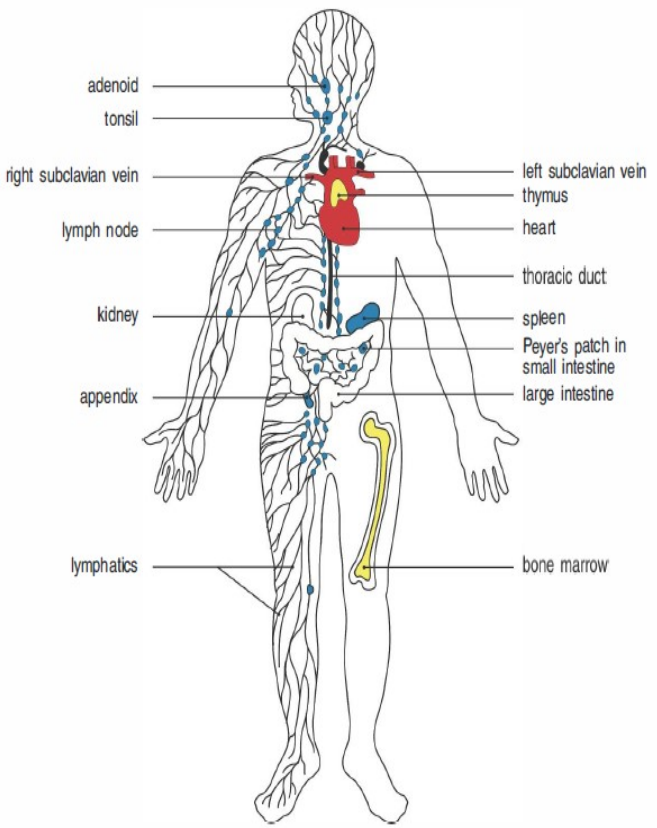
ORGAN LIMFOID

Organ Limfoid Primer

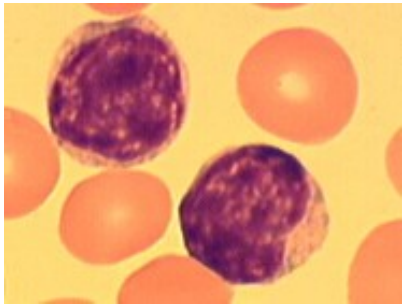
- Timus, Sumsum tulang belakang
- Embriogenesis dari sel-sel imunogenik → kompartemen sentral

Organ Limfoid Sekunder

- Kelenjar limfa, lmfa, dan jaringan limfoid
- Bereaksi aktif terhadap stimulasi antigen → kompartemen perifer



Lymphocytes



- Produce antibodies
- B-cells mature in bone marrow then concentrate in lymph nodes and spleen
- T-cells mature in thymus
- B and T cells mature then circulate in the blood and lymph
- Circulation ensures they come into contact with pathogens and each other

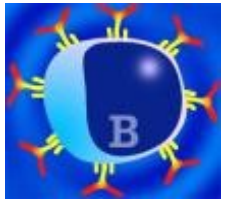
B -Lymphocytes

- There are c.10 million different B-lymphocytes, each of which make a different antibody.
- The huge variety is caused by genes coding for abs changing slightly during development.
- There are a small group of clones of each type of B-lymphocyte

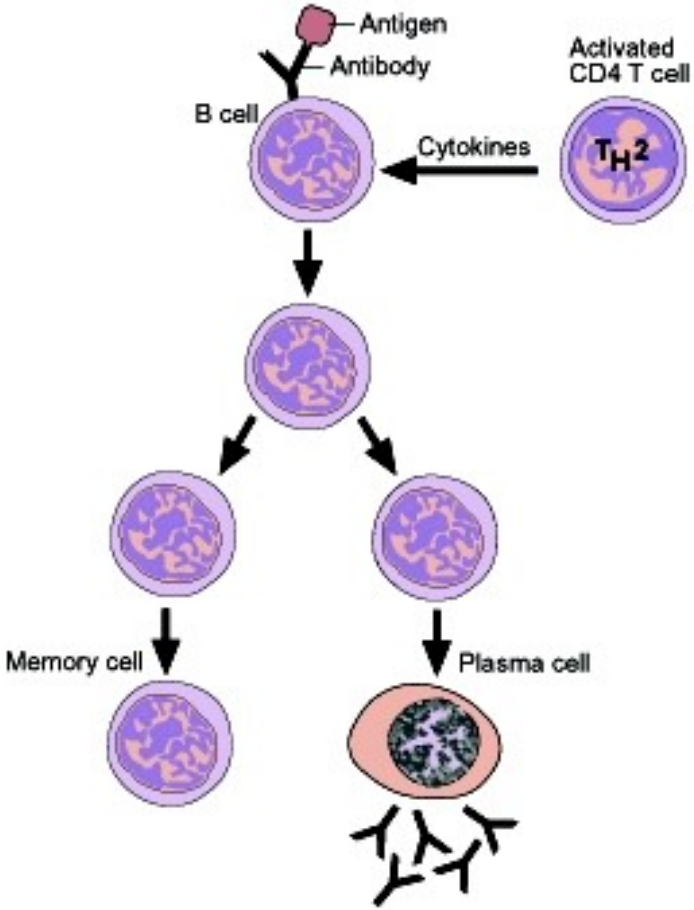
B -Lymphocytes

- At the clone stage antibodies do not leave the B-cells.
- The abs are embedded in the plasma membrane of the cell and are

  called antibody receptors.
- When the receptors in the membrane recognise and antigen on the surface of the pathogen the B-cell divides rapidly.
- The antigens are presented to the B-cells by macrophages



B -Lymphocytes

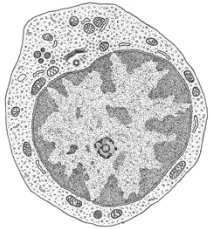


B -Lymphocytes

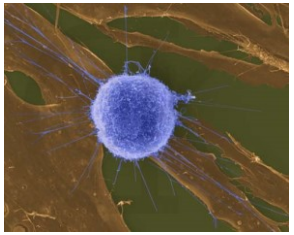
- Some activated B cells → PLASMA CELLS these produce lots of antibodies, < 1000/sec
- The antibodies travel to the blood, lymph, lining of gut and lungs.
- The number of plasma cells goes down after a few weeks
- Antibodies stay in the blood longer but eventually their numbers go down too.

B -Lymphocytes

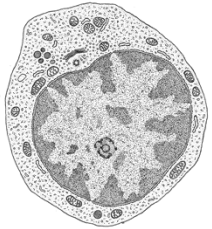
- Some activated B cells → MEMORY CELLS.
- Memory cells divide rapidly as soon as the antigen is reintroduced.
- There are many more memory cells than there were clone cells.
- When the pathogen/infection infects again it is destroyed before any symptoms show.



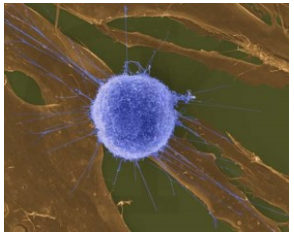
T-Lymphocytes



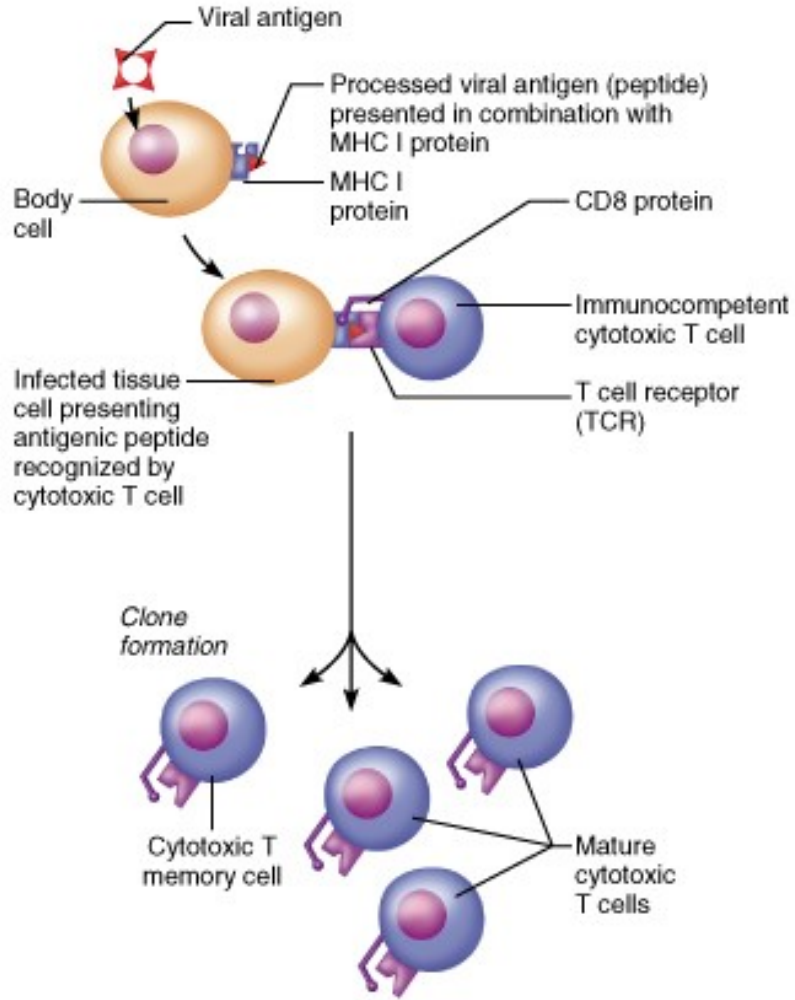
- Mature T-cells have T cell receptors which have a very similar structure to antibodies and are specific to 1 antigen.
- They are activated when the receptor comes into contact with the Antigen with another host cell (e.g. on a macrophage membrane or an invaded body cell)



T-Lymphocytes

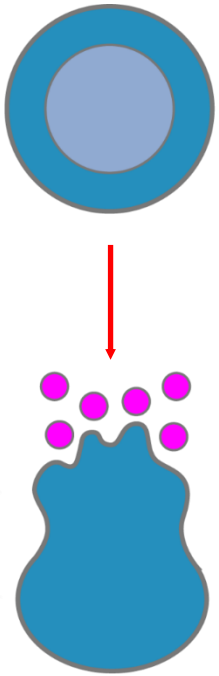


- After activation the cell divides to form:
- T-helper cells – secrete CYTOKINES
  - → help B cells divide
  - → stimulate macrophages
- Cytotoxic T cells (killer T cells)
  - → Kill body cells displaying antigen
- Memory T cells
  - → remain in body



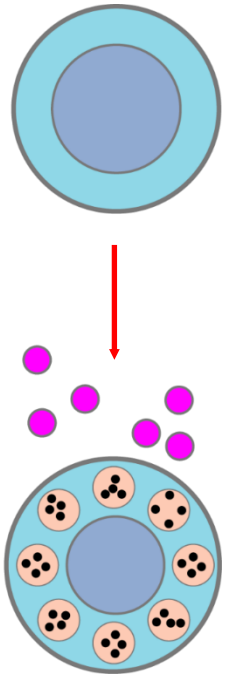
T Cells

Resting helper T cell



Activated helper T cell

Resting cytotoxic T cell



Activated killer cell

Active and Passive Immunity

Active immunity

Lymphocytes are activated by antigens on the surface of pathogens

Natural active immunity - acquired due to infection

Artificial active immunity – vaccination

Takes time for enough B and T cells to be produced to mount an effective response.

Active and Passive Immunity

Passive immunity

B and T cells are not activated and plasma cells have not produced antibodies.

The antigen doesn't have to be encountered for the body to make the antibodies.

Antibodies appear immediately in blood but protection is only temporary.

Active and Passive Immunity

Artificial passive immunity

Used when a very rapid immune response is needed e.g. after infection with tetanus.

Human antibodies are injected. In the case of tetanus these are antitoxin antibodies.

Antibodies come from blood donors who have recently had the tetanus vaccination.

Only provides short term protection as abs destroyed by phagocytes in spleen and liver.

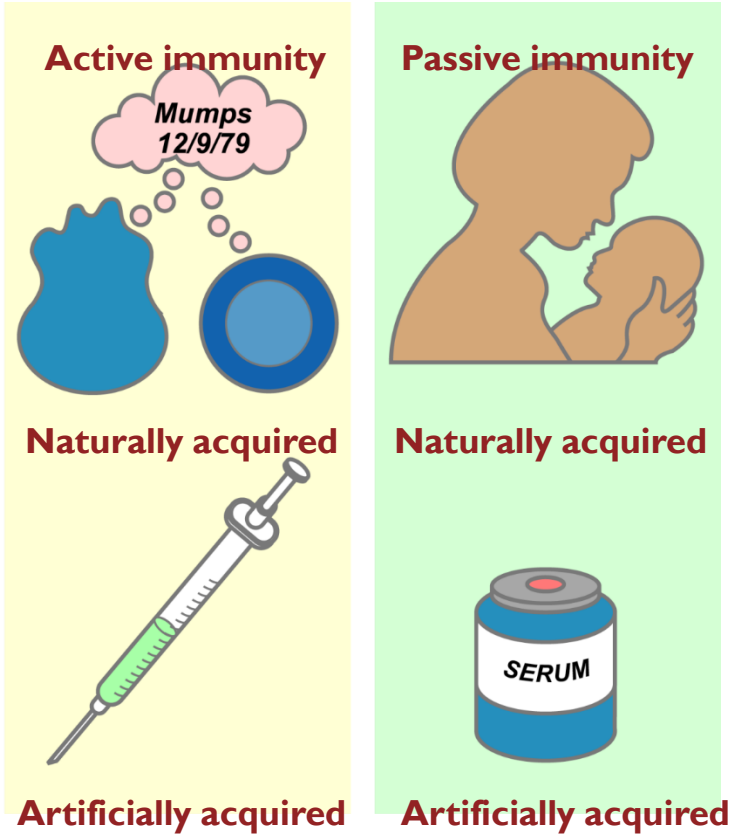
Active and Passive Immunity

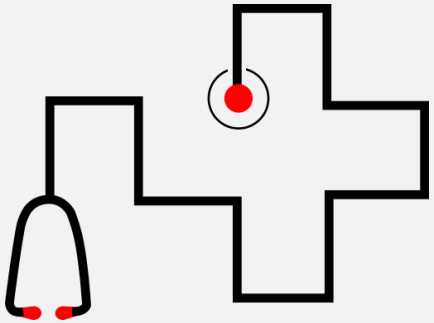
Natural passive immunity

A mother's antibodies pass across the placenta to the foetus and remain for several months.

Colostrum (the first breast milk) contains lots of IgA which remain on surface of the baby's gut wall and pass into blood

Immunity: Active and Passive





Thank you