

Unit II

B Cell Activation

Slides were made from YouTube

Cellular Immunity

- Major Point: T cells will destroy infected cells
- Steps:
 1. Person is exposed to a pathogen
 2. Pathogen enters/infects a body cell
 3. Antigens of the pathogen are displayed on the infected cell
 4. Phagocyte swallow and destroy a pathogen



Medieval times:

Body parts of executed prisoners were displayed around the kingdom as a reminder of what happens to rebellions.



Immune

non-specific

carriers
line

-inflammatory
-phagocytes

white blood
leukocyte

specific / adaptive

lymphocytes

B-lymphocytes

↳ bone marrow

humoral
response

T-lymphocytes

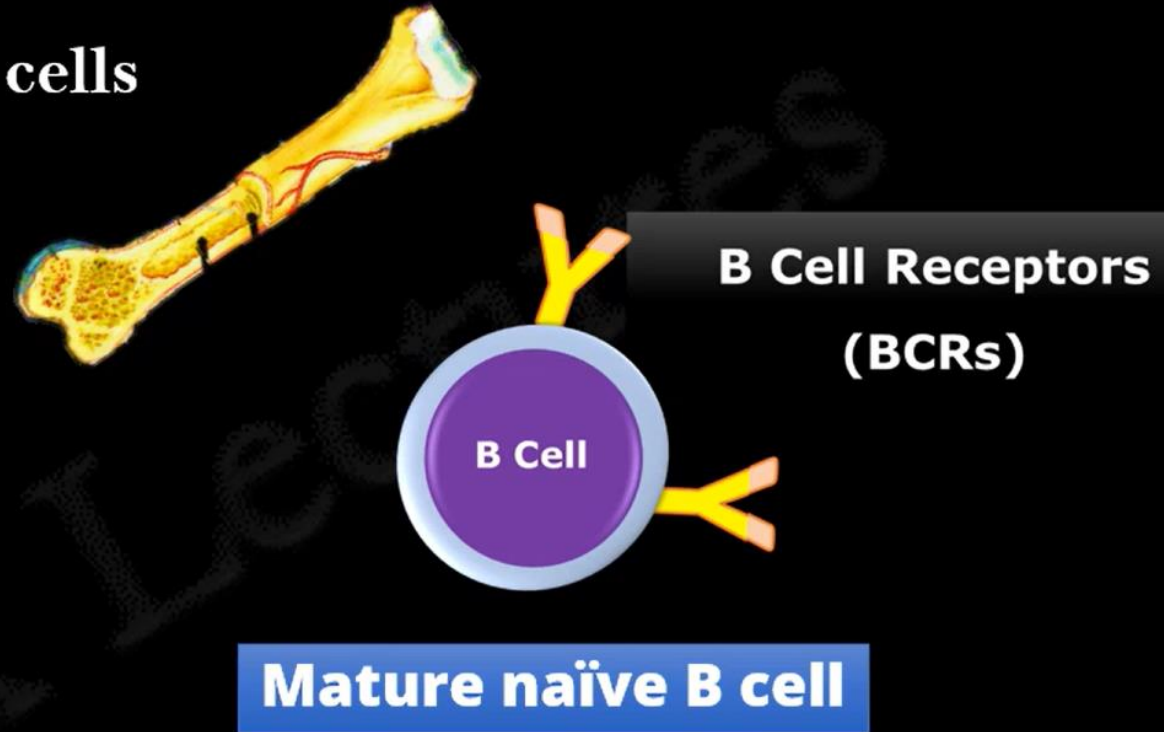
↳ Thymus

Cell mediated

T_H

T_C

**Origin and maturation of B cells
occurs in the bone marrow**



- B cells leave the bone marrow and recirculate between the blood, the secondary lymphoid tissues and the lymph.

B Cell Activation



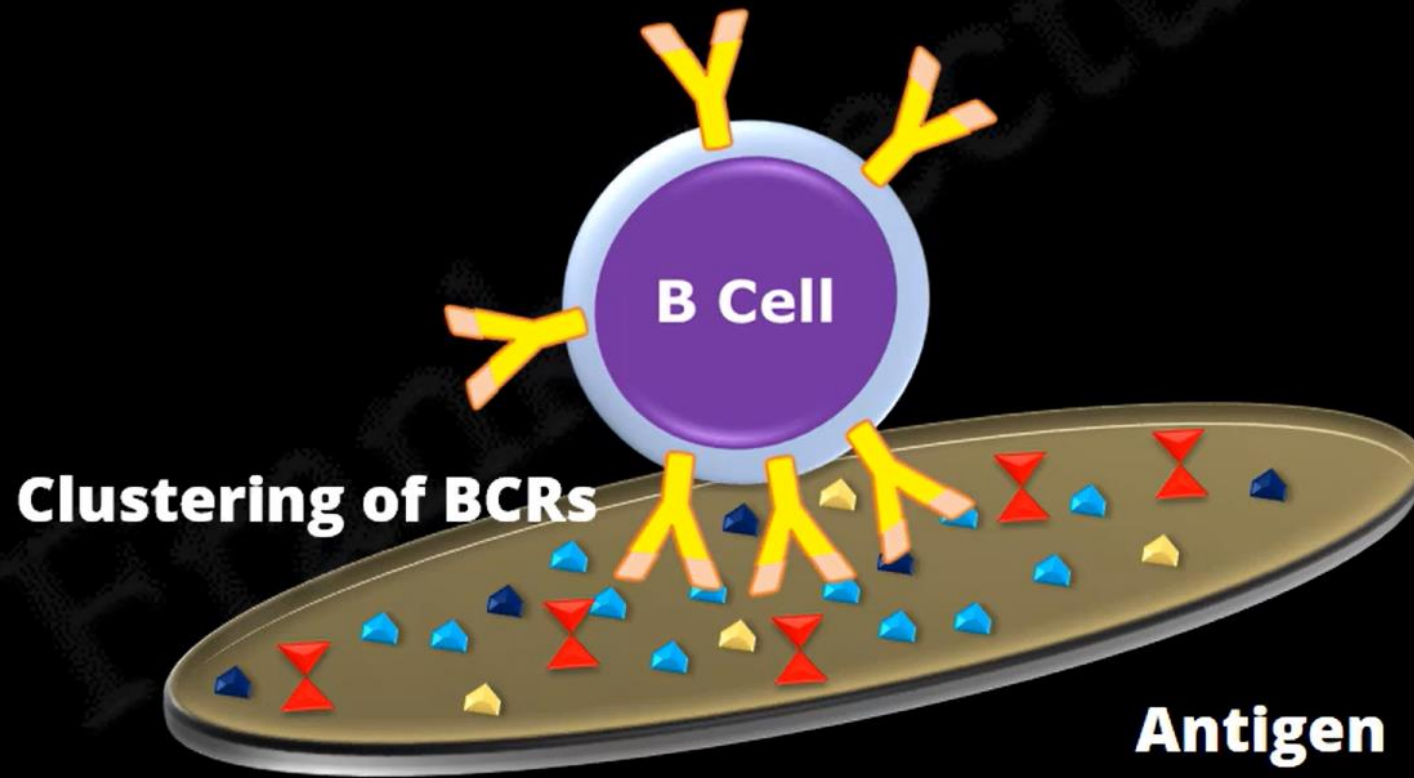
T cell **independent**
Activation

T cell **dependent**
Activation

- Based on the **type of antigen encountered by the B cells.**

Activate B cells without T cell help

Such antigens are : **polysaccharides, glycolipids, nucleic acids**



B Cell Activation



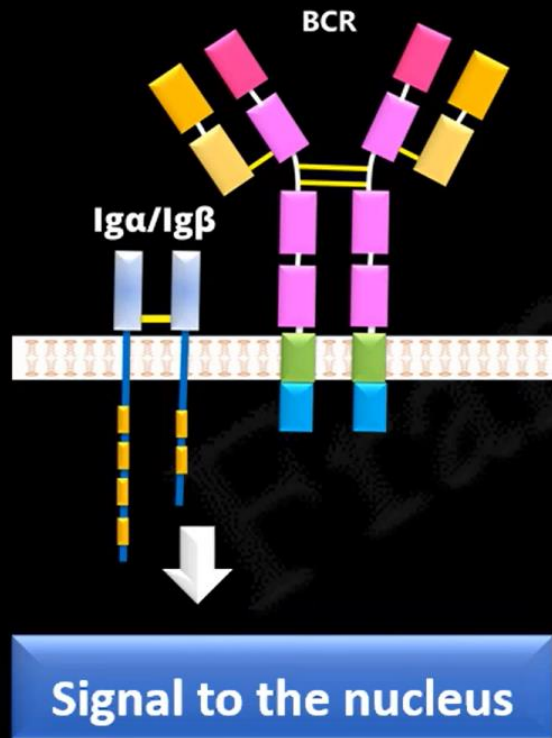
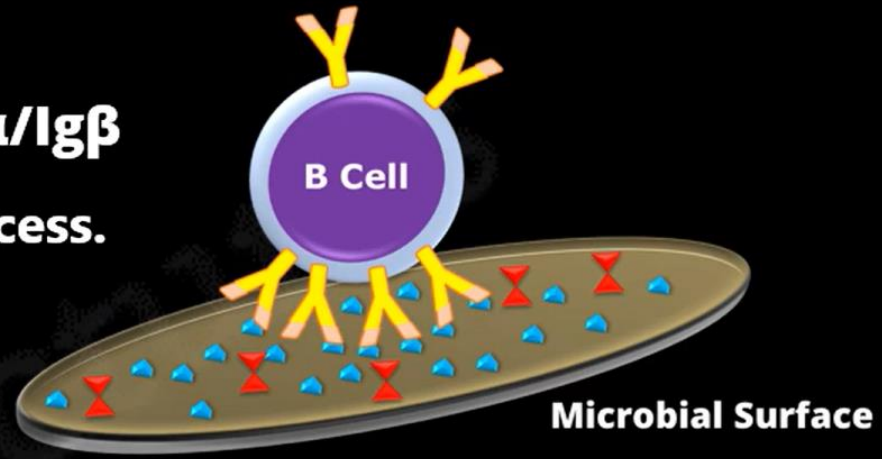
```
graph TD; A[B Cell Activation] --- B[T cell independent Activation]; A --- C[T cell dependent Activation];
```

**T cell independent
Activation**

**T cell dependent
Activation**

- Based on the **type of antigen encountered by the B cells.**

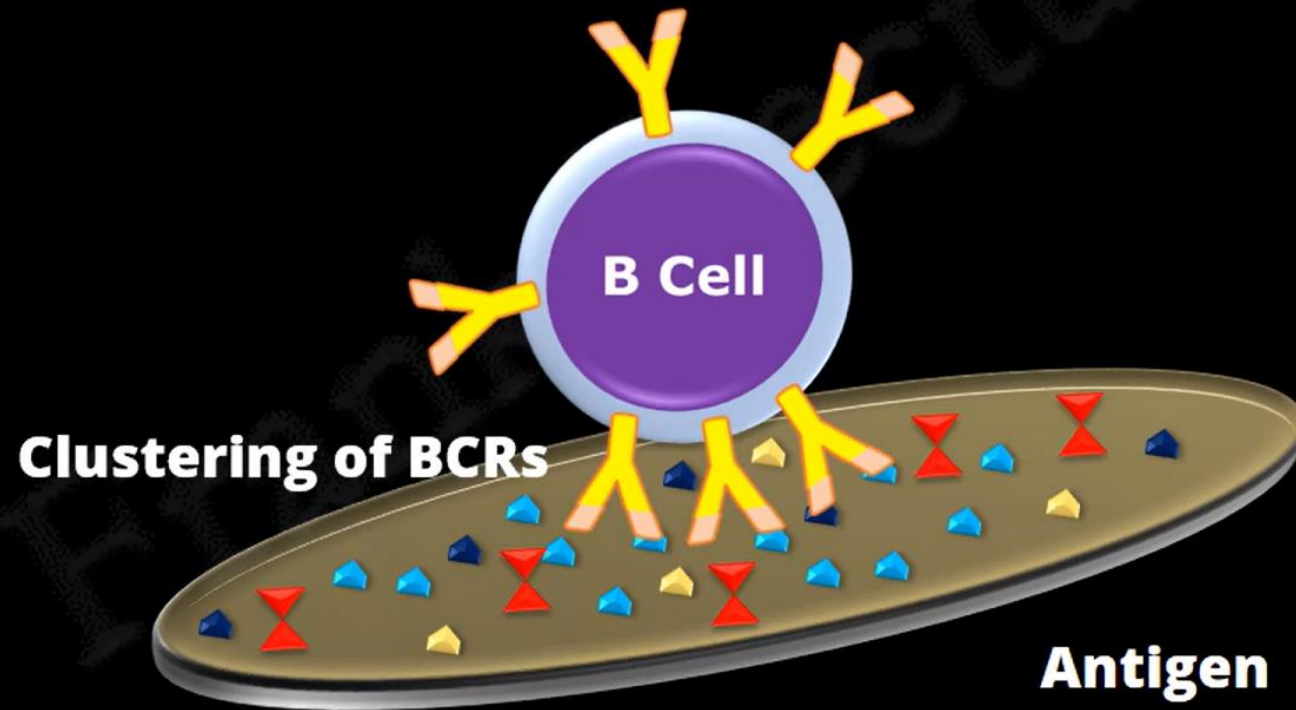
Clustering of BCRs activates multiple $Ig\alpha/Ig\beta$ molecules and initiate the signaling process.



Clustering of B cell receptors depends on the type of antigen encountered.

Activate B cells without T cell help

Such antigens are : **polysaccharides, glycolipids, nucleic acids**



The antigens which can trigger B cell activation **without T cell help** are called **T-independent** or **thymus independent (Ti)** antigens.

B cell activation without T cell help is known as **T-independent B cell Activation.**

Most antigens are proteins

But not present as multiple repeating epitopes.

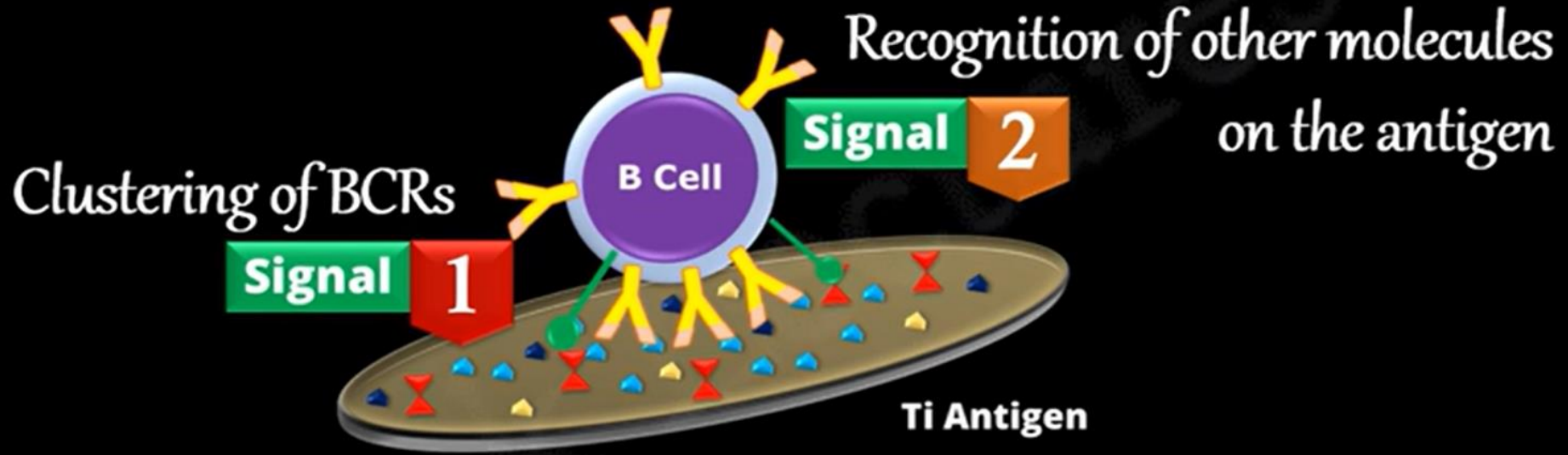
Thus, clustering of B cell receptors is difficult.

B cell activation requires T cell help.

Antigens that trigger B cell activation **with the help of T helper cells** are known as **T dependent** or **thymus dependent (Td)** antigens.

B cell activation which requires T cell help is known as T-dependent B cell Activation.

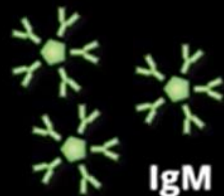
T Independent B cell Activation



**Proliferation and Differentiation
of the activated B cell**



Plasma Cell



IgM

*Memory cells
are not produced

B Cell Activation



**T cell independent
Activation**

**T cell dependent
Activation**

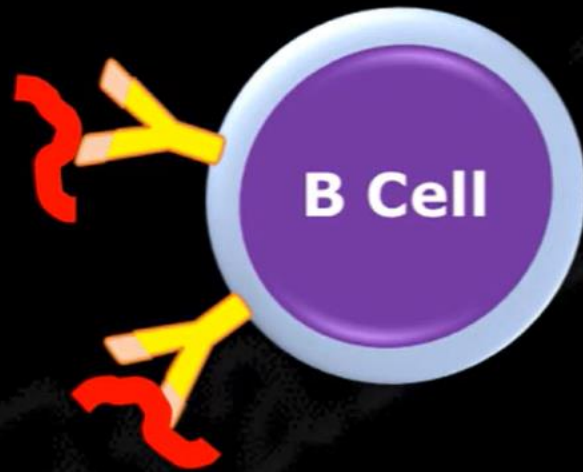
- Based on the **type of antigen encountered by the B cells.**

Protein antigens CANNOT crosslink multiple BCRs.

- **Lack repetitive and identical epitopes**

Protein antigens **CANNOT** crosslink multiple BCRs.

- Lack repetitive and identical epitopes



B cell Activation
requires T cell help

 Td antigen (Protein Antigen)

T Dependent

B cell Activation is a.....

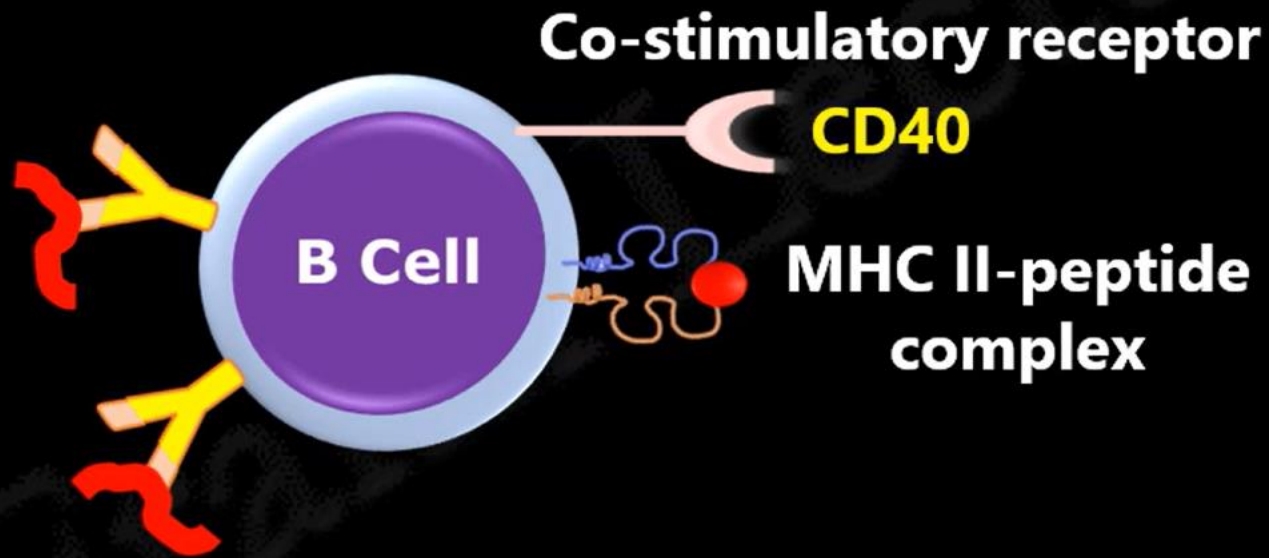
Three Signal Process

T Dependent B cell Activation

Signal

1

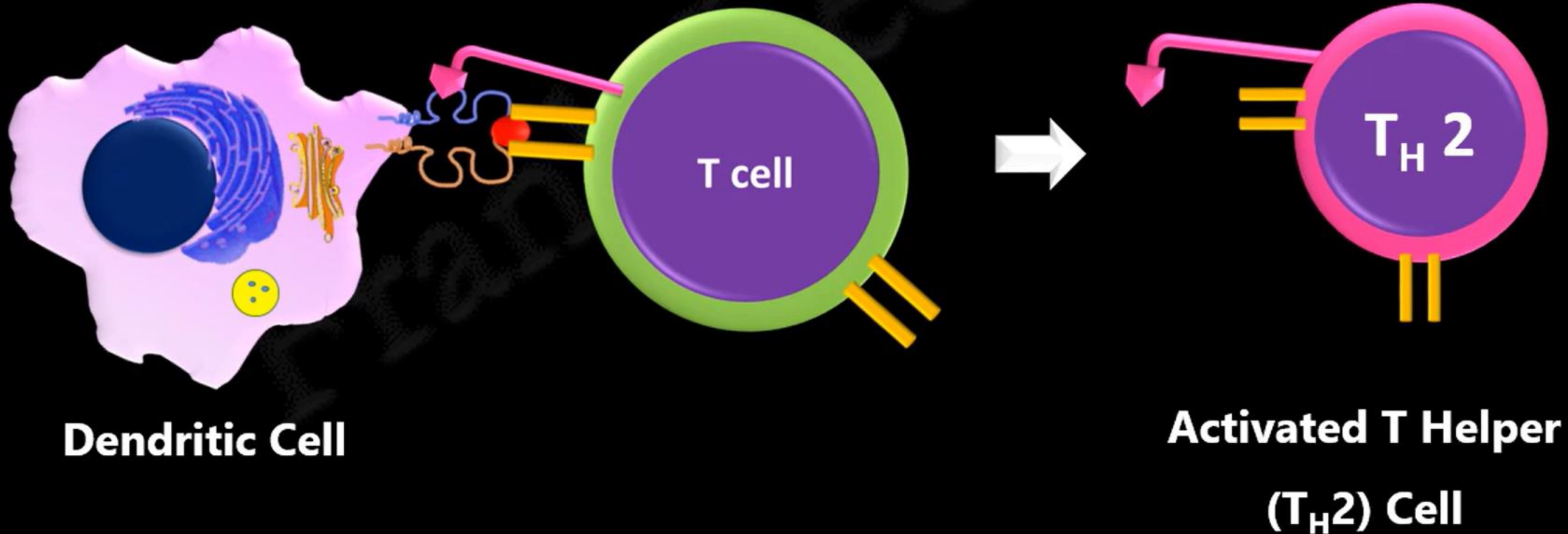
Antigen Recognition and Binding by B cell



 Td antigen (Protein Antigen)

T Dependent B cell Activation

The same antigen is also recognized by mature naïve CD4⁺ T cell (or Helper T cell).



T Dependent B cell Activation

Signal

1

Antigen Recognition and Binding by B cell

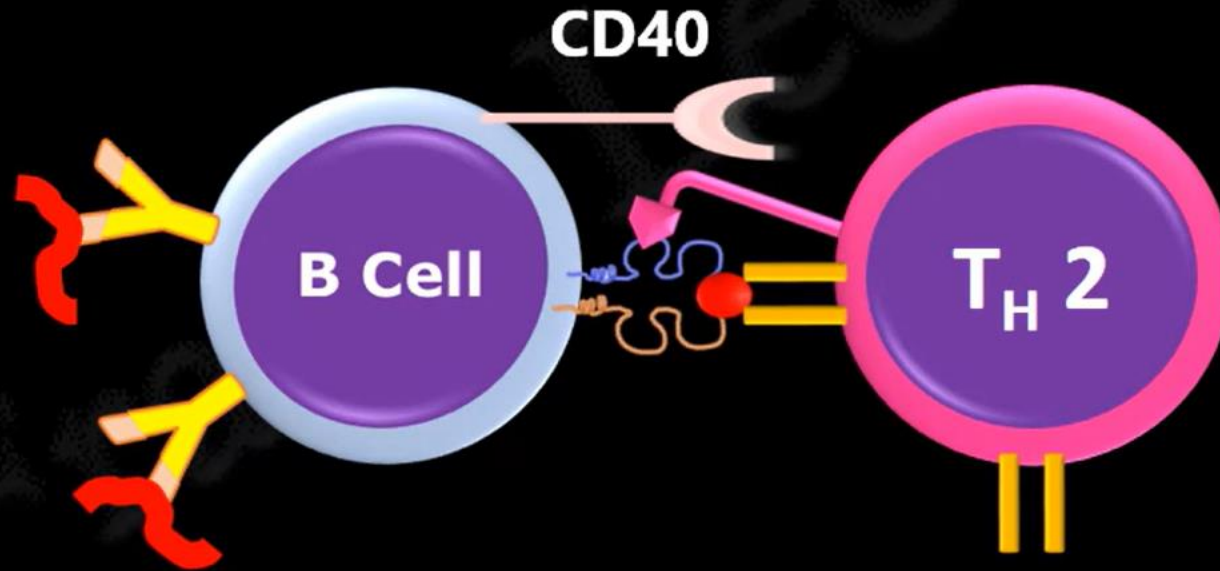


T Dependent B cell Activation

Signal

2

Derived from B and T cell interactions

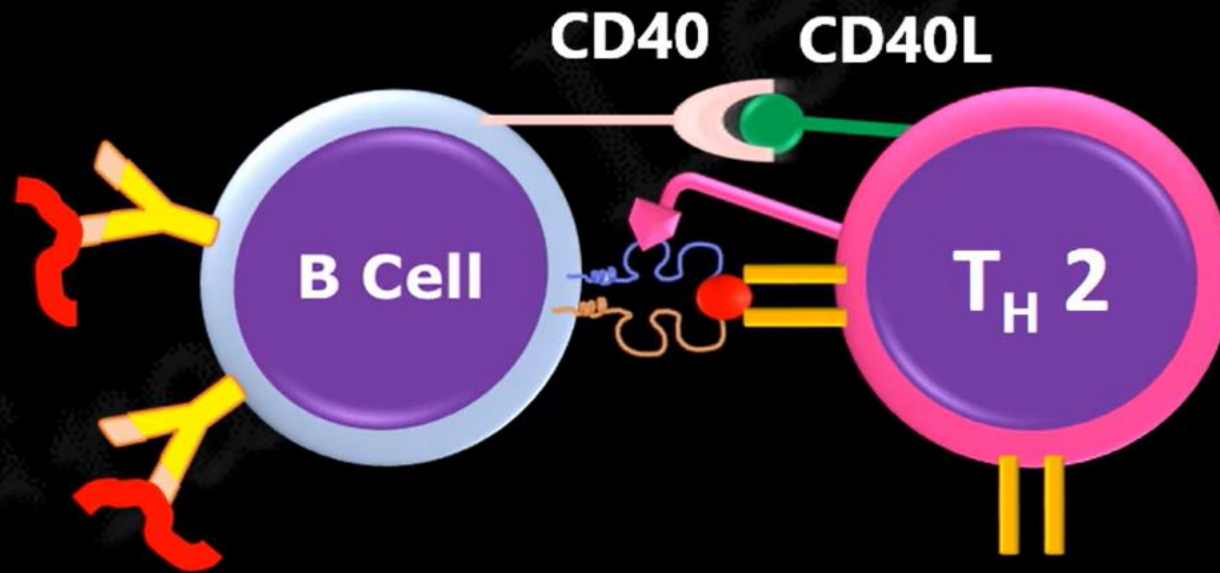


T Dependent B cell Activation

Signal

2

Derived from B and T cell interactions

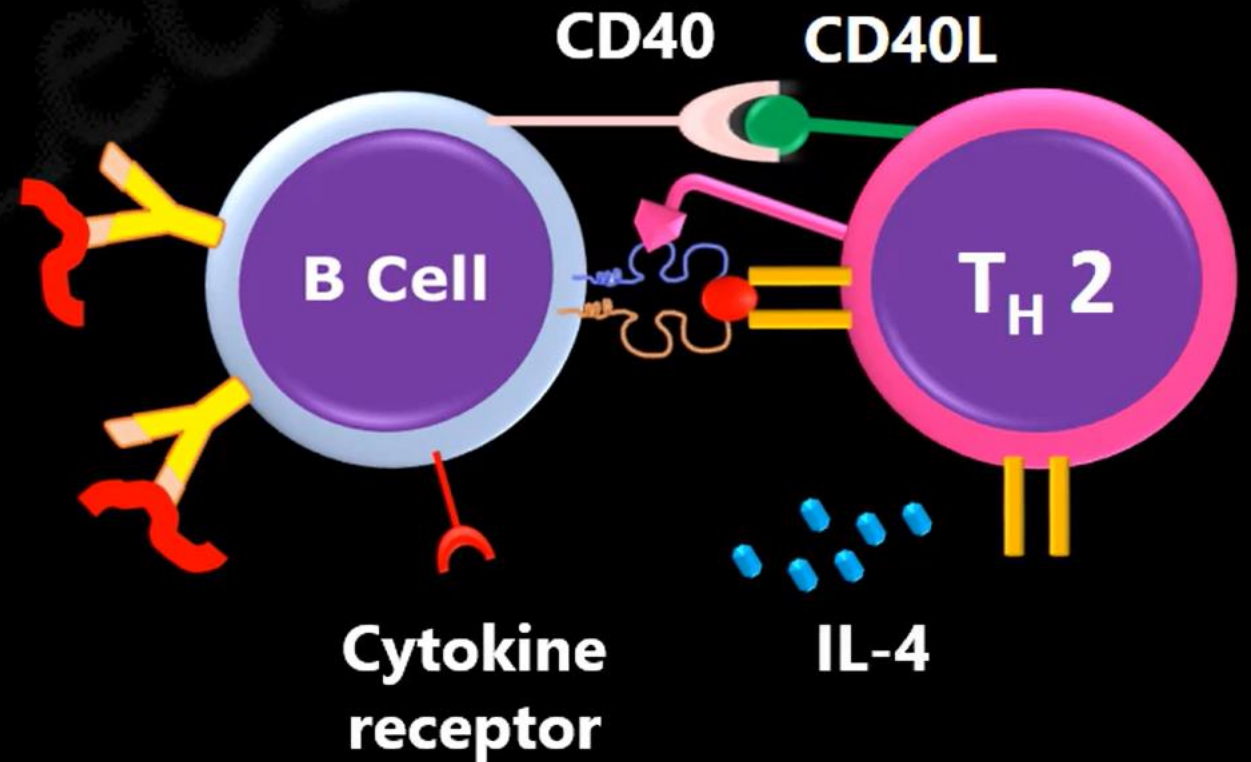


T Dependent B cell Activation

Signal

3

Cytokines released by the T Helper cell stimulate B cell

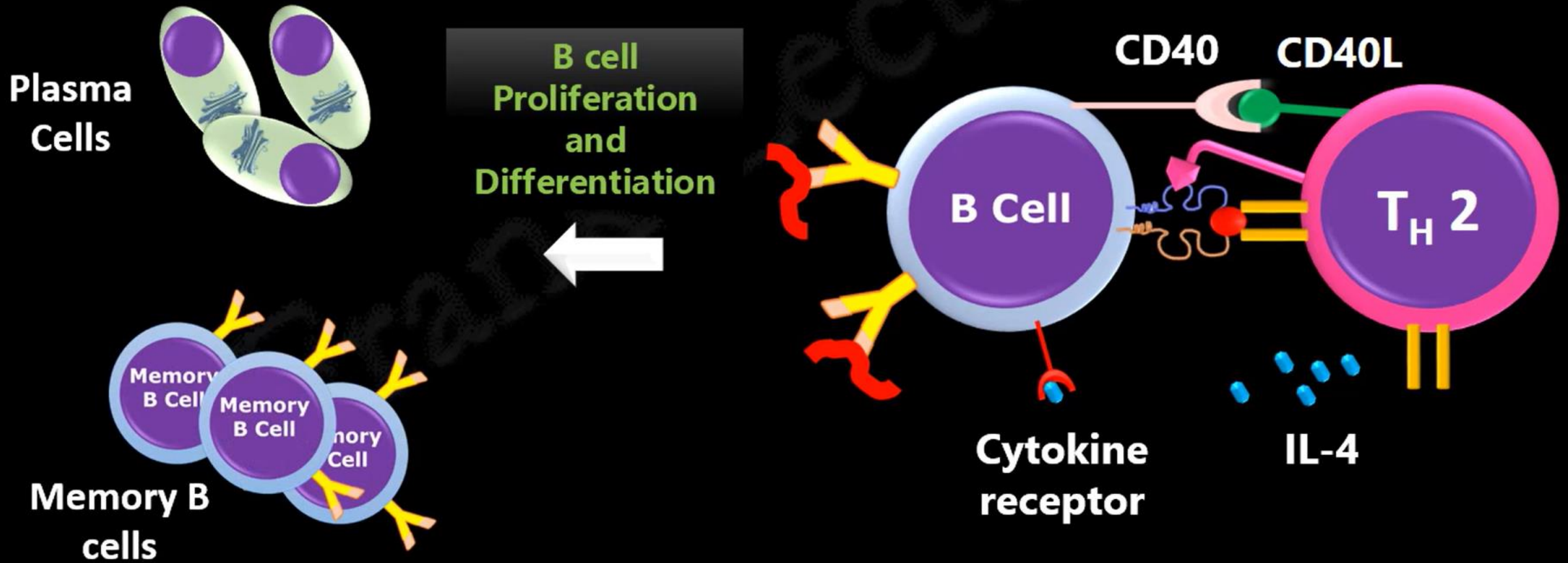


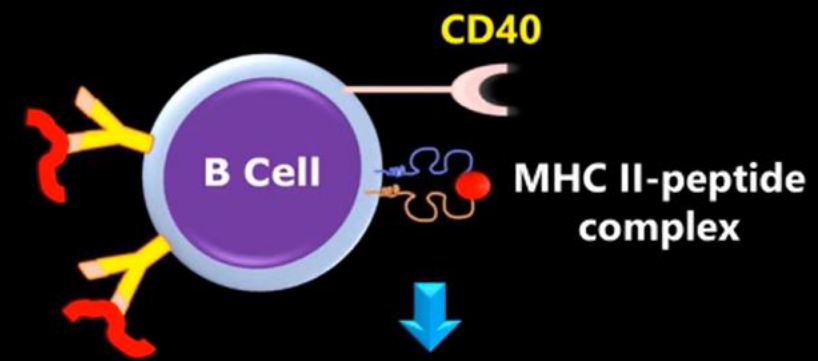
T Dependent B cell Activation

Signal

3

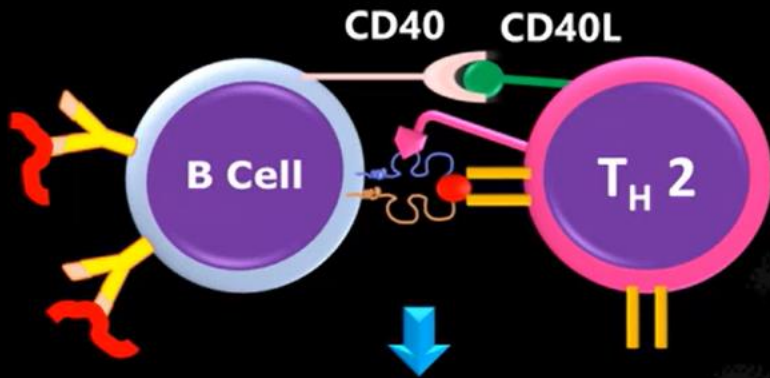
Cytokines released by the T Helper cell stimulate B cell





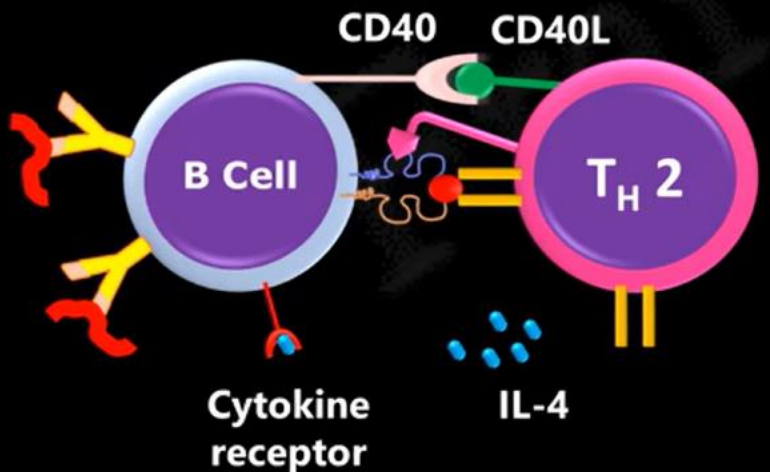
Antigen Recognition and Binding by B cell

Signal 1



B and T cell Interaction (CD40-CD40L binding)

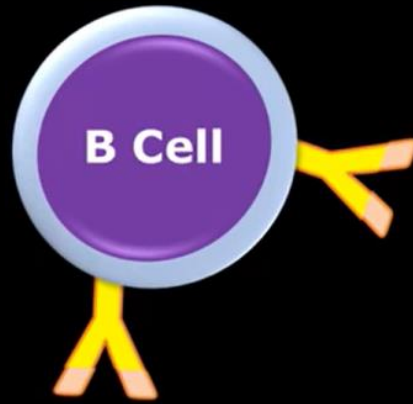
Signal 2



Cytokine Help by T Helper cells

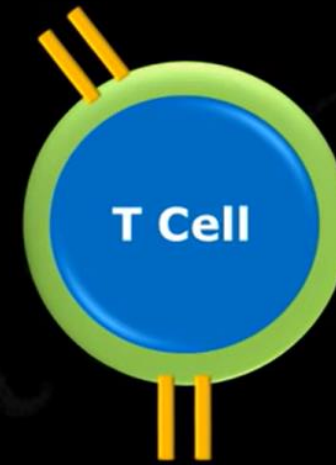
Signal 3

T Dependent B cell Activation



B cells **recognize variety of antigens.**

- Proteins
- Polysaccharides
- Nucleic acids
- Lipids



T cells **recognize only protein antigens**

- Peptides
- **MHC-peptide Complex**