Immunoglobulin Classes

IgG

- Functions are:
    1. The major immunoglobulin in secondary immune response.
    2. The only antibody that passes through the placenta because **placenta has receptors for its Fc portion.**
    3. Antitoxin & neutralize viruses
    4. **Complement fixation through its Fc portion.**
    5. **Opsonization of bacteria** by coating them and attaching them to macrophages **through its Fc portion.**

IgM

IgM antibodies generally remain in blood vessels without entering the surrounding tissues.

- Functions are:
    1. The major antibody in the primary immune response.
    2. The major **agglutinating** antibody.
    3. Complement fixation.
    4. Antigen receptor on the surface of B lymphocytes. **(It is attached to the cell surface through Fc portion).**
    5. It is the class of antibodies formed against ABO antigens.

IgA

- This class is found in both serum and mucosal surfaces.

- IgA present in the serum is called **serum IgA** and it is found in the **monomeric** form.
- IgA present at mucosal surfaces is called **secretory IgA.** It is found in the **dimeric** form.

1- The main function of secretory IgA is probably to prevent the attachment of microbial pathogens to mucosal surfaces. This is especially important in resistance to intestinal and respiratory pathogens.
2- Because IgA immunity is relatively short-lived, the length of immunity to many respiratory infections is correspondingly short.
3- IgA's presence in a mother's milk, especially the colostrum probably helps protect infants from gastrointestinal infections.

IgD

- It acts as antigen receptor on the surface of mature B lymphocytes. **(It is attached to the cell surface through Fc portion).**

has no well-defined function .

IgE

IgE molecules bind tightly by their Fc (stem) regions to receptors on mast cells and basophils.

1- When an antigen such as pollen cross-links with the IgE antibodies attached to a mast cell or basophil that cell releases histamine and other chemical mediators.
2- The concentration of IgE is greatly increased during some allergic reactions and parasitic infections, which is often diagnostically useful.

B Cells and Humoral Immunity

As we have seen, the humoral (antibody-mediated) response is carried out by antibodies. Antibodies are produced by a special group of lymphocytes called B cells.

Mechanism of antibody production:

Clonal selection:

- The immune system has a large pool of B lymphocytes.
- Each B cell carries on its surface a specific receptor **(IgM and IgD)** that recognize a specific antigen.
- When an antigen enters the body, only one B lymphocyte will proliferate to form a clone of antigen specific B lymphocytes.

❖ *Activation of B lymphocytes:*

- Mechanism of activation of B cells differ according to the type of antigen:

1- T cell-dependent antigen

An activated B cell undergoes clonal expansion, or proliferation. B cells usually require the assistance of a T helper cell (T_H) as shown in Figure (17-4)

T-dependent antigens are mainly **proteins**, such as those found on viruses, bacteria, foreign red blood cells, and haptens with their carrier molecules.

For antibodies to be produced in response to a T-dependent antigen, it is necessary that both B and T cells be activated and interact.

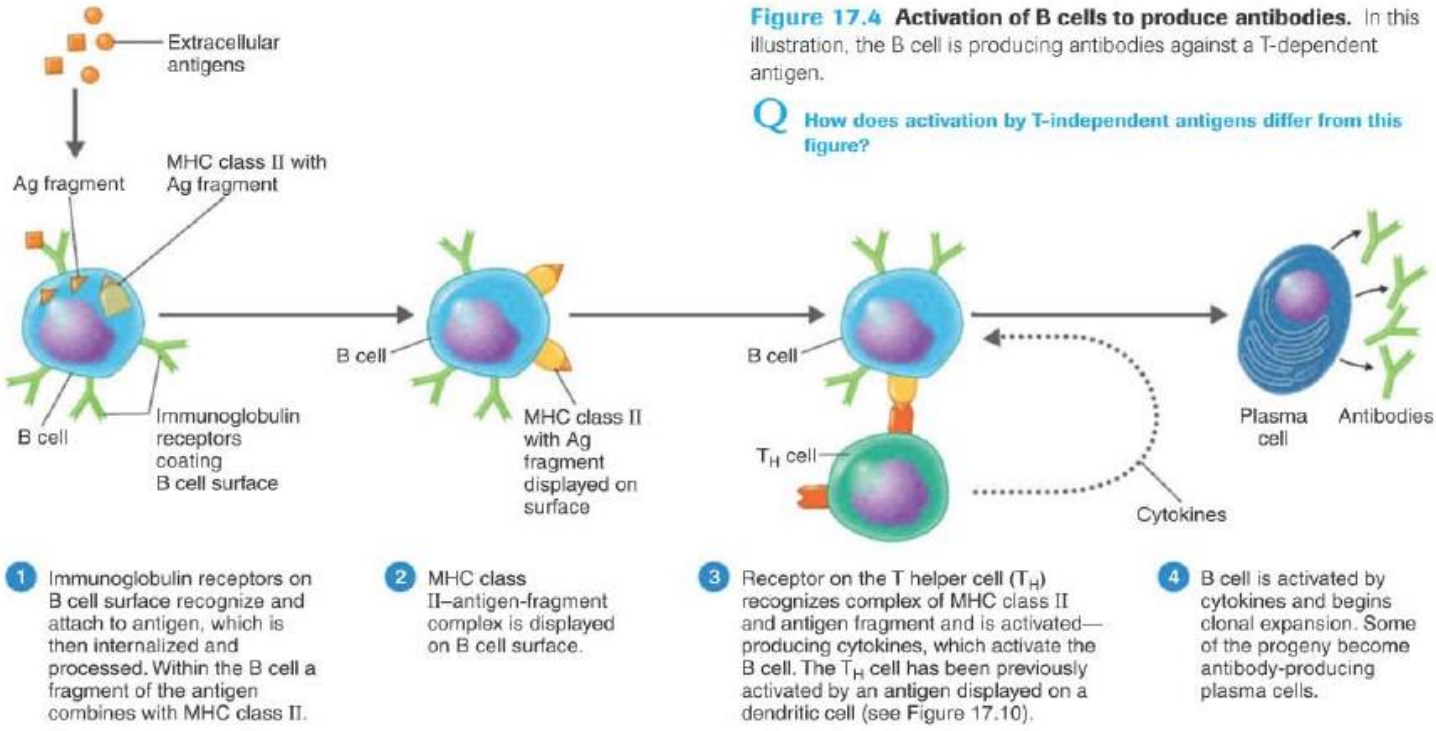


Figure 17.4 Activation of B cells to produce antibodies. In this illustration, the B cell is producing antibodies against a T-dependent antigen.

Q How does activation by T-independent antigens differ from this figure?

The process is initiated when the B cell contacts an antigen. It is important to note that the antigen contacts the surface immunoglobulins on the B cell and is enzymatically processed within the B cell and that fragments of it are combined with the major histocompatibility complex (MHC).

The MHC is a collection of genes that encode molecules of genetically diverse glycoproteins that are found on the plasma membranes of mammalian nucleated cells. in humans the MHC is also called the human leuckocyte antigen (HLA) system. The combination of the antigenic fragments and the MHC are then displayed on the B cell's surface for the receptors on the T helper cells to identify.

In this instance, the MHC is of class II, which is found only on the surface of antigen-presenting cells (APCs)-in this case, a B cell.

As shown in Figure 17.4, the T_H cell in contact with the antigenic fragment presented on the surface of the B cell

becomes activated and begins producing cytokines. These deliver a message that causes the activation of the B cell. An activated B cell proliferates into a large clone of cells, some of which will differentiate into

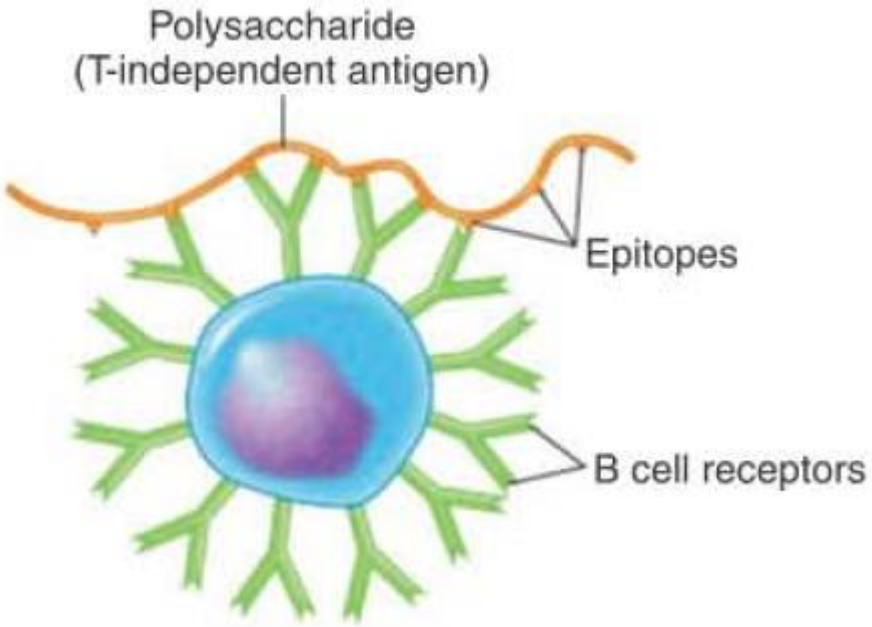
- ✓ **antibody-producing plasma cells.**
- ✓ Other clones of the activated B cell become **long-lived memory cells** that are responsible for the enhanced secondary response to an antigen.

2- T cell-independent antigens

- These antigens are characterized by repeating subunits such as are found in polysaccharides or lipopolysaccharides. Bacterial capsules are often good examples of T-independent antigens.
- These antigens interact with IgM receptor on B lymphocyte surface stimulating it directly to produce specific antibodies.

The repeating subunits, as shown in the following Figure can bind to multiple B cell receptors, which is probably why they do not require T cell assistance. T-independent antigens generally provoke a weaker immune response than do T-dependent antigens.

- ✓ This response is composed primarily of IgM, and no memory cells are generated.



Item	T cell dependent antigen	T cell independent antigen
Nature	Protein	Polysaccharide with repeated subunits of sugars
Memory cells	present	absent
Secondary immune response	occurs	Does not occur
Immunoglobulin class switch	Occurs (IgM is produced in primary immune response then IgG is produced in secondary immune response)	Does not occur (Only IgM is produced, no IgG is produced)