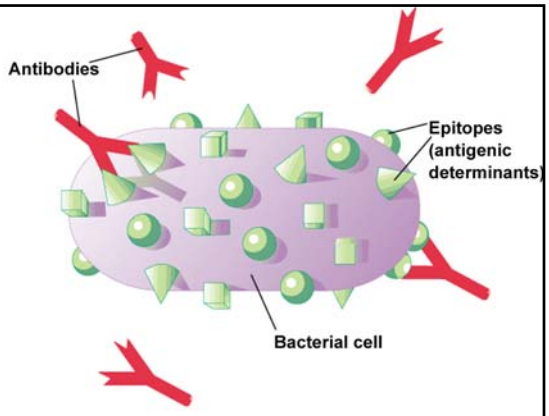
Antigens

- **Immunogen – a molecule that specifically interacts with an antibody or lymphocyte and elicits an immune response**
- **Antigenic determinants (epitopes)**

16-1



16-2

Figure 16.3 – Antibodies and Antigens

Antibodies

- **Structure**
- **Protective outcomes**
- **Immunoglobulin classes**

16-3

Structure

- **Antigen – binding (Fab) site**
- **Fc region**
- **Heavy chains and light chains**
- **Variable region (Fab)**
- **Constant region (Fc)**

16-4

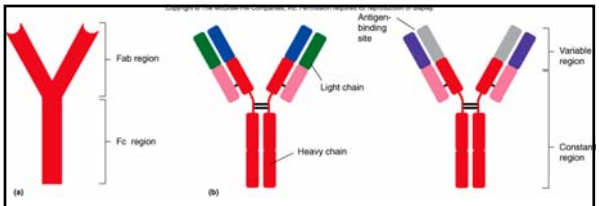
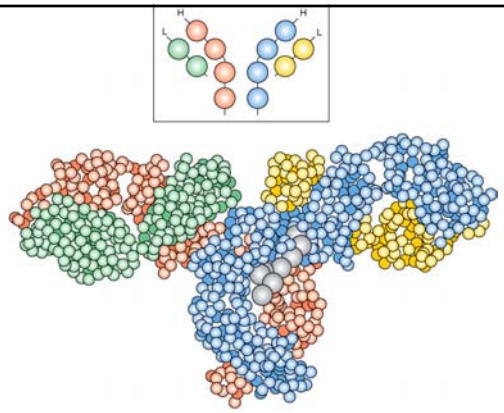


Figure 16.4 Antibody structure

16-5



16-6

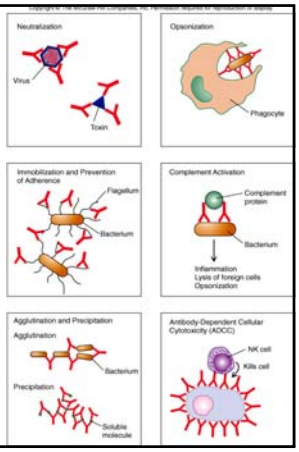
Figure 16.5 – Model of an IgG Molecule

Protective outcomes

- Neutralization
- Immobilization and prevention of adherence
- Agglutination and precipitation
- Opsonization
- Complement activation
- Antibody – dependent cellular cytotoxicity (ADCC)

16-7

Figure 16.6
Protective outcomes of Ab-Ag binding



16-8

Immunoglobulin classes

- IgM (pentamer) – first class produced
- IgG (monomer) – 80-85% total serum Ig; secondary response
- IgA (dimer in secretions) – secreted Ab; mucosal immunity
- IgD (monomer) – minor Ab involved in development
- IgE (monomer) – bound to basophils and mast cells, important in elimination of parasites, allergies

16-9

Table 16.1 Characteristics of the Various Classes of Human Immunoglobins

Class and Molecular Weight (daltons)	Structure	Percent of Total Serum Immunoglobulin (Half-life in serum)	Properties	Functions
IgG 146,000	Monomer	80%–85% (21 days)	Specific attachment to phagocytes; complement fixation; ability to cross placenta	Agglutination; precipitation; opsonization; ADCC; complement activation
IgM 970,000	Pentamer	5%–13% (10 days)	Complement fixation; first antibody produced during the primary immune response; only class produced in response to T-independent antigens	Agglutination; precipitation; complement activation
IgA monomer 160,000; secretory IgA 390,000	Dimer in secretions	10%–13% (6 days)	Secreted into saliva, milk, mucus, and other secretions; secretory form resists enzymatic degradation	Protection of mucous membranes by preventing attachment of organisms (mucosal immunity)
IgD 184,000	Monomer	<1% (3 days)		Involved with development and maturation of the antibody response; functions have not been clearly described
IgE 188,000	Monomer	<0.01% (2 days)	Attaches to mast cells and basophils; cell-bound IgE that binds antigen causes the cell to release its granule contents	Involved in many allergic reactions; functions in ADCC; helps to expel parasites

16-10

Table 16.1 Classes of immunoglobulins

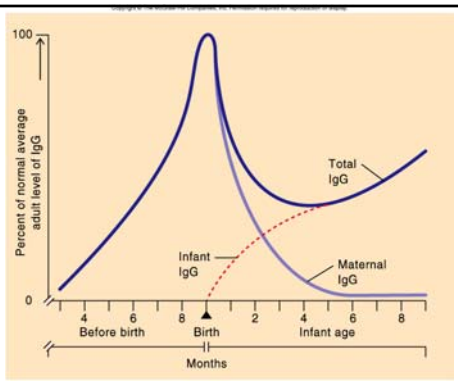


Figure 16.7 – Immunoglobulin G Levels in the Fetus and Infant

16-11

Names for antibodies based on protective outcome:

agglutinin – IgG antibody that agglutinates antigen

precipitin – IgG antibody that precipitates antigen

opsonin – IgG that coats antigen to promote phagocytosis

complement fixing antibody – leads to complement lysis

antitoxin – neutralizes antigen

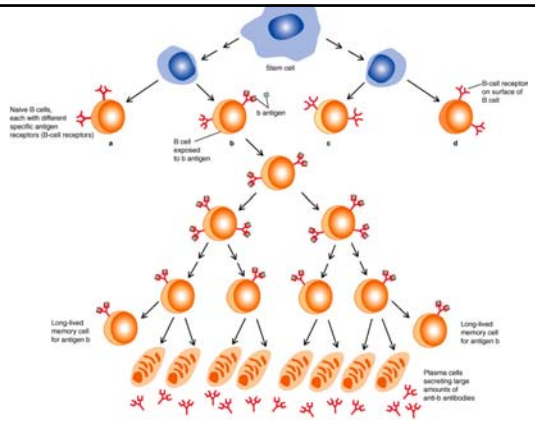
neutralizing antibody – neutralizes ability of virus to infect

16-12

Clonal selection

- Specific response of a lymphocyte to an antigen
- Lymphocytes
  - Immature
  - Naïve
  - Activated
  - Effector
  - Memory

16-13



16-14

Figure 16.8 Clonal selection

B - lymphocytes

- Response to T – dependent antigens
- Response to T – independent antigens

16-15

Response to T – dependent antigens

- B cells present antigen (usually protein) to effector T cells
- B cell clonal expansion – affinity maturation, class switching and memory
- Primary and secondary response

16-16

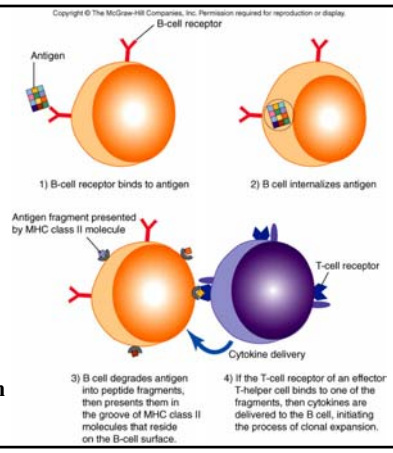


Figure 16.9 B cell and T cell interaction

16-17

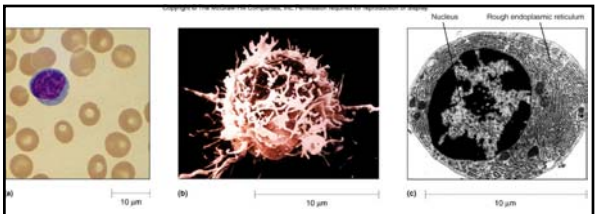
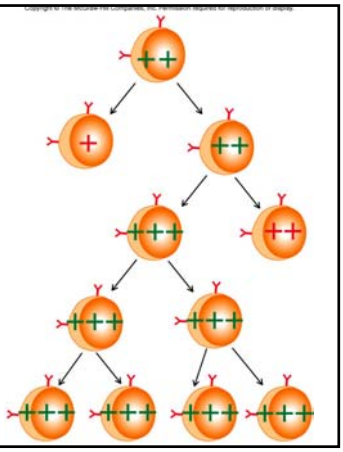


Figure 16.10 – Lymphocytes and plasma cells

16-18

Figure 16.12
Affinity maturation in B cells



16-19

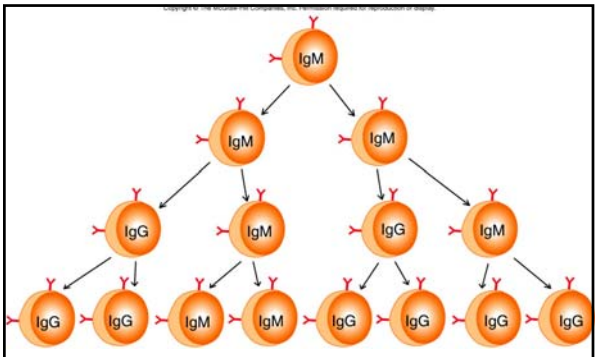
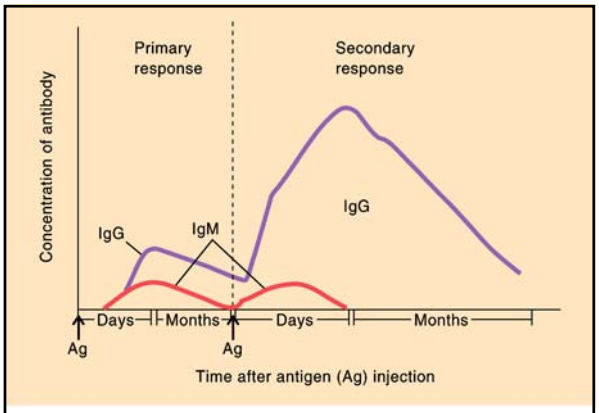


Figure 16.13 – Class switching in B cells and plasma cells

16-20

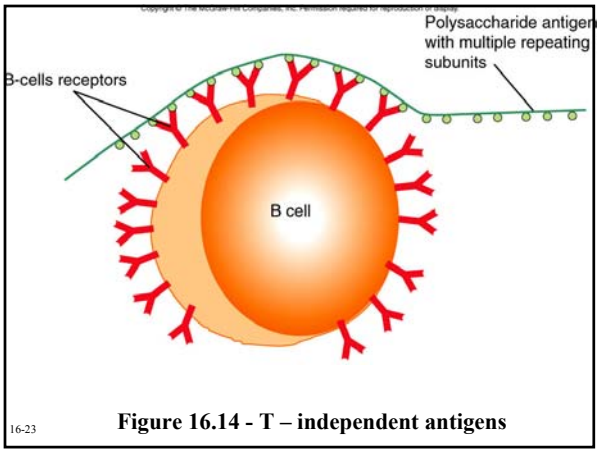


16-21 **Figure 16.11 – Primary and secondary response**

Response to T – independent antigens

- **Polysaccharides – trigger B cell response**
- **No T – helper cells are involved**

16-22



16-23 **Figure 16.14 - T – independent antigens**