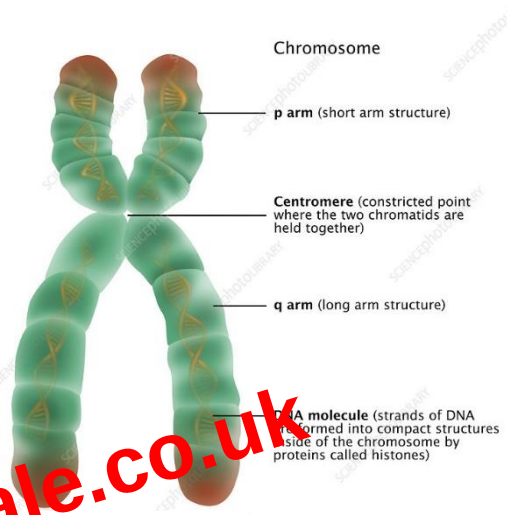
Step 2 – Filtration

Large cell and tissue debris are removed. Organelles pass through the gaps

Step 3 – ultracentrifugation

The cell fragments are poured into a tube and spun first at a low speed in a centrifuge. The large organelles collect at the bottom in a dense pellet, the remainder is the liquid is the supernatant. Supernatant is then poured off, spun again at a higher speed to collect smaller organelle. This process continues until the supernatant is centrifuged to the correct speed that will give the desired organelle.

Cell cycle and Mitosis



Chromosome structure

- Each chromosome consists of two chromatids joined somewhere along its length with a centromere
- Genetic information carried on each chromatid is identical

Cell cycle – sequence of cell growth and division

Interphase

- Cell growth
- Synthesis of organelles
- DNA copying and checking of genetic information

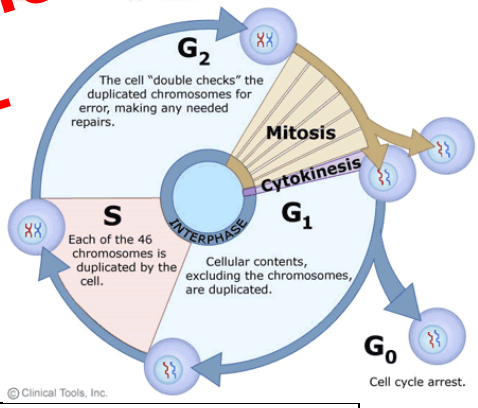
Mitosis

- Chromosomes divide

Cytokinesis

- Cytoplasm divided between the daughter cells

Interphase is the longest phase and is split into G1, S, G2



G1	First growth phase involves the manufacture of proteins to form cell organelles. This is a very active phase; cellular checks are made to ensure that DNA is in good enough condition to replicate.
S	Synthesis phase, when DNA is replicated, and chromosomes duplicated
G2	Second growth phase, organelles grow and divide, energy stores are increased.
G0	Cell is not in cell cycle. E.g. death

Mitosis – refers to the process of nuclear division that occurs before a cell physically divides in two. It is the formation of two new identical daughter cells from an original cell

Cytokinesis – involves formation of a cleavage funnel which pinches the cell in two. In plant cells it involves the formation of a cell plate

Cell Recognition and the immune system

- Antigen – proteins and glycoproteins on cells surface. These are self or foreign.
- Antibody – also called immunoglobins, Y shaped proteins produced to attack pathogens.
- Phagocyte – type of cell that engulfs and absorbs pathogens
- Phagosome – a vesicle formed around a pathogen engulfed by a phagocyte
- Lysosome – organelles that contain digestive enzymes

Nonspecific defences:

- 1st line of defence: skin, mucus membranes, chemicals
- 2nd line of defence: phagocytosis, complement, interferon, inflammation, fever

Specific defence:

- 3rd line of defence: lymphocytes, antibodies

Phagocytosis

1. Chemoattractant: chemical products of the foreign body
2. Amoeboid movement: move by altering their shape
3. Pseudopodia: false feet that extent around foreign body
4. Phagosome: membrane bound vesicle with foreign matter
5. Lysosome: vesicle bound enzyme packets

The Specific Response: T and B Lymphocyte cells

B Lymphocytes mature in **B**one marrow

T Lymphocytes mature in the **T**hymus gland

B Lymphocytes:

- Produce antibodies
- Respond to foreign materials outside body cells
- Respond to bacteria and viruses

T Lymphocytes:

- Involved in cell mediated immunity
- Respond to own cells altered by viruses etc
- Respond to foreign materials outside body cells

Cell mediated response involves highly specialised cells targeting body cells

Memory cells:

- Cells that circulate in the blood after the pathogen has been removed. If stimulated, they divide and rapidly produce a secondary immune response.

B Cells and Humoral Immunity

- Antibodies are proteins that recognise and bind to specific antigens
- Antigens are foreign substances that stimulate the production of antibodies
- Many of the molecules on the surface of viruses and bacteria are antigens

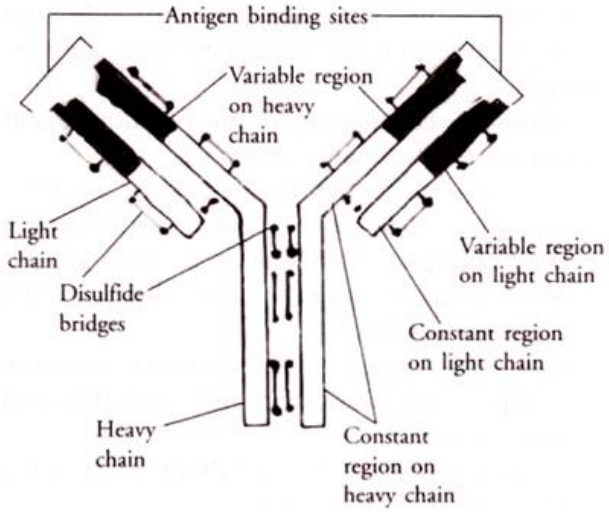


Fig. 7 Structure of an immunoglobulin molecule.

Roles of antibodies:

- Agglutination – antibodies can cause microbes to stick together, making it easier for phagocytes to engulf them
- Neutralisation – the antibodies neutralizes the toxins produced by pathogens
- Antibodies can stop viruses attaching to host cells
- Opsonisation – binding of antibody to the surface of a pathogen can set off a chain reaction with blood proteins which causes the pathogen to swell up and burst.

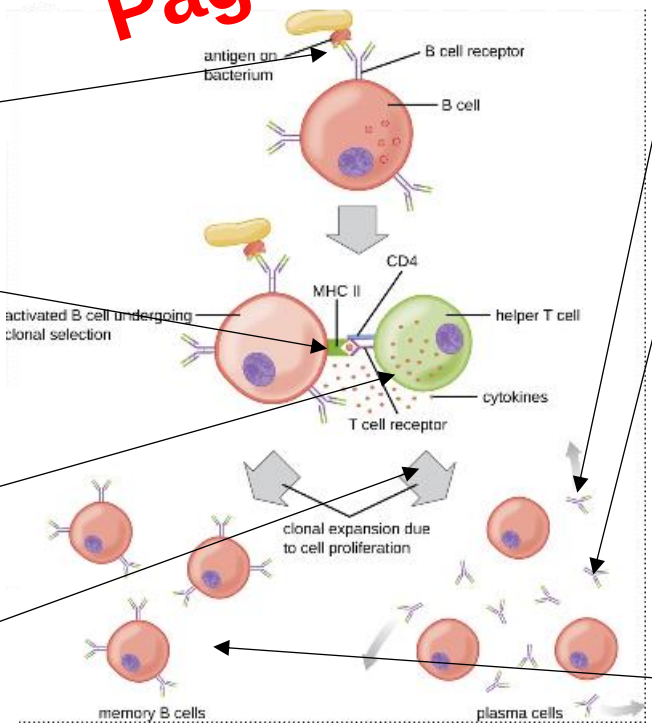
Humoral Immunity:

Surface antigens of the invading pathogen are taken up by B cells.

The B cells process the antigens and present them on their surface.

T helper cells activated in the process, attach to the processed antigens on the B cells thereby activating them.

The B cells are now activated by mitosis to give a clone of plasma cells



The cloned plasma cells produce antibodies that are complementary to the antigens on the pathogens surface.

The antibodies attach to antigens on the pathogen and destroy them. This is the primary immune response.

Some B cells develop into memory cells. These can respond to future infections by the same pathogen by dividing rapidly and developing into plasma cells that produce antibodies. This is the secondary immune response.