Higher Human Biology

Non-Specific defence

The body defends itself against pathogens, toxins and cancer cells by means of its Immune System.

Immunity – ability to resist infection by a pathogen or to destroy it if it invades.

The body has 3 lines of defence.

First two are **non-specific**, work against any type of disease causing agent

First line of defence, mechanism employed (non-specific)

1. Skin (physical and chemical defence)

2. Acid secretions by stomach

3. Mucus secretion, epithelial lining of trachea

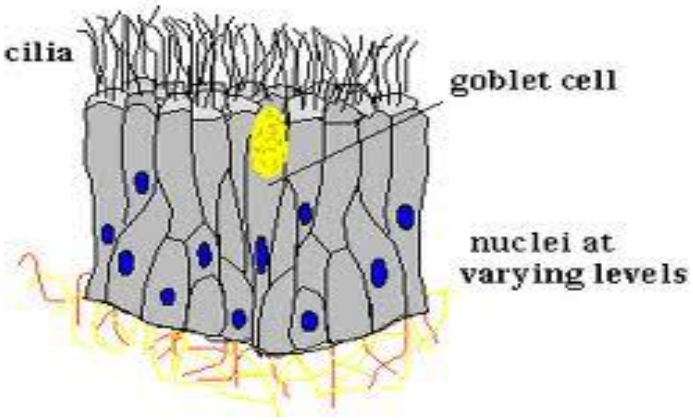
Skin surface is a physical barrier preventing entry of microbes.

Skin is made up of epithelial cells.

Epithelial cells also include the cells lining body cavities.

Epithelial cells produce chemical secretions which act against pathogens including:-

- Secretions from sweat and sebaceous glands keep skin at pH too low for microbes to thrive.
- Secretions from tears and saliva contain the enzyme lysozyme, digests bacterial walls.
- Acid is secreted by the epithelial lining of the stomach and destroys many microbes.
- Cells in mucous membranes of the windpipe (trachea) secrete sticky mucus to trap microbes.
- Ciliated epithelial cells in trachea sweep the mucus and trapped microbes away from lungs.



Any pathogens which get through the first line of defence are attacked again by a second line of defence.

Second line of defence, mechanism employed **(non-specific)**

This is the first response against tissue injury e.g. a splinter or wasp sting where the skin barrier is breached. The following three responses are part of this second level of non-specific defence .

1. Inflammatory response

2. Phagocytosis

3. Natural killer cells

Inflammatory response – Following an injury

This is a localised defence mechanism at affected site.

Mast cells, specialised immune cells, are present in the epithelial cells connective tissue and contain **histamine** which is released when cells are damaged.

Histamine causes:

- blood vessels to widen (vasodilation) - this increases the blood flow to the area)
- capillaries to become more permeable and leak fluid into tissues

Fluid leakage allows various substances which help protect against infection to spread to surrounding tissues. These include:-

a) Cytokines - cell signalling molecules which summon **phagocytes** to the area.

b) Antimicrobial proteins which kill bacteria.

c) Clotting Factors – The clots which form prevent further microbes entering the bloodstream are formed by an enzyme called **thrombin.**

Phagocytes (see above) - These are white blood cells summoned by the cell signalling cytokines.

Phagocytes recognise foreign surface proteins or **antigenic markers** on the surface of pathogens.

Phagocytes engulf the invader in a vacuole and lysosomes fuse with the vacuole, releasing digestive enzymes into it.

Following digestion of a microbe, phagocytes release more cytokines (signalling proteins) which attract Natural Killer (NK) cells.

Natural killer cells

NK cells are not phagocytes.

They attack virus affected cells and cancer cells.

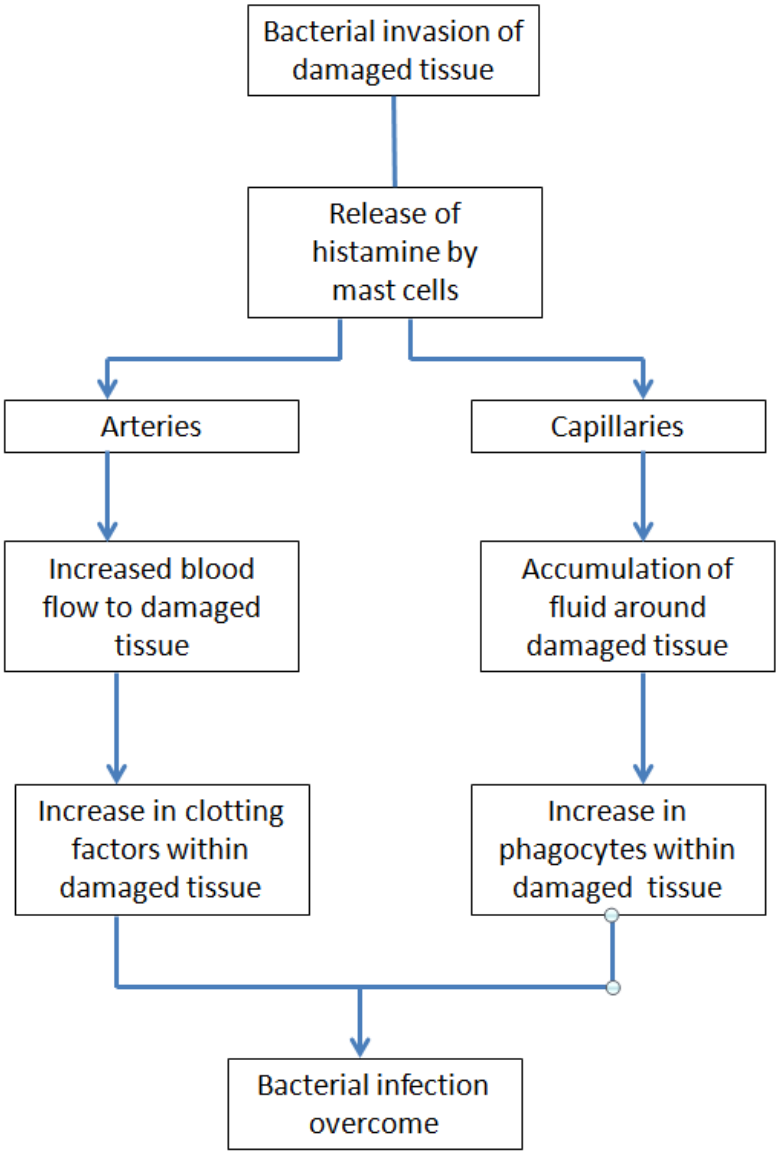
NK cells induce the pathogen to destroy itself – this is called **cell apoptosis.**

NK cells cause cell apoptosis by releasing a protein that causes the pathogen to produce self destructive digestive enzymes.

Pathogen breaks down into useless fragments after digestion.

Both NK cells and phagocytes release cytokines into the blood stream to stimulate the next level of defence called the specific immune system.

Here is an example where the non-specific immune system deals with a bacterial invasion which gets through the first line of defence;



Look back at the previous pages to describe the effect of histamine on the arteries and capillaries and explain why these changes in both types of blood vessel are important in helping to overcome the bacterial invasion.