3.1.3

Internal Non-Specific Defense Mechanisms

The internal non-specific defense mechanisms, or innate immune responses, are only active if the physical barriers are ineffective in preventing the entry of a potential pathogen into our bodies. Once activated these defense mechanisms are very effective at limiting the spread of pathogens and causing their destruction.

Inflammation

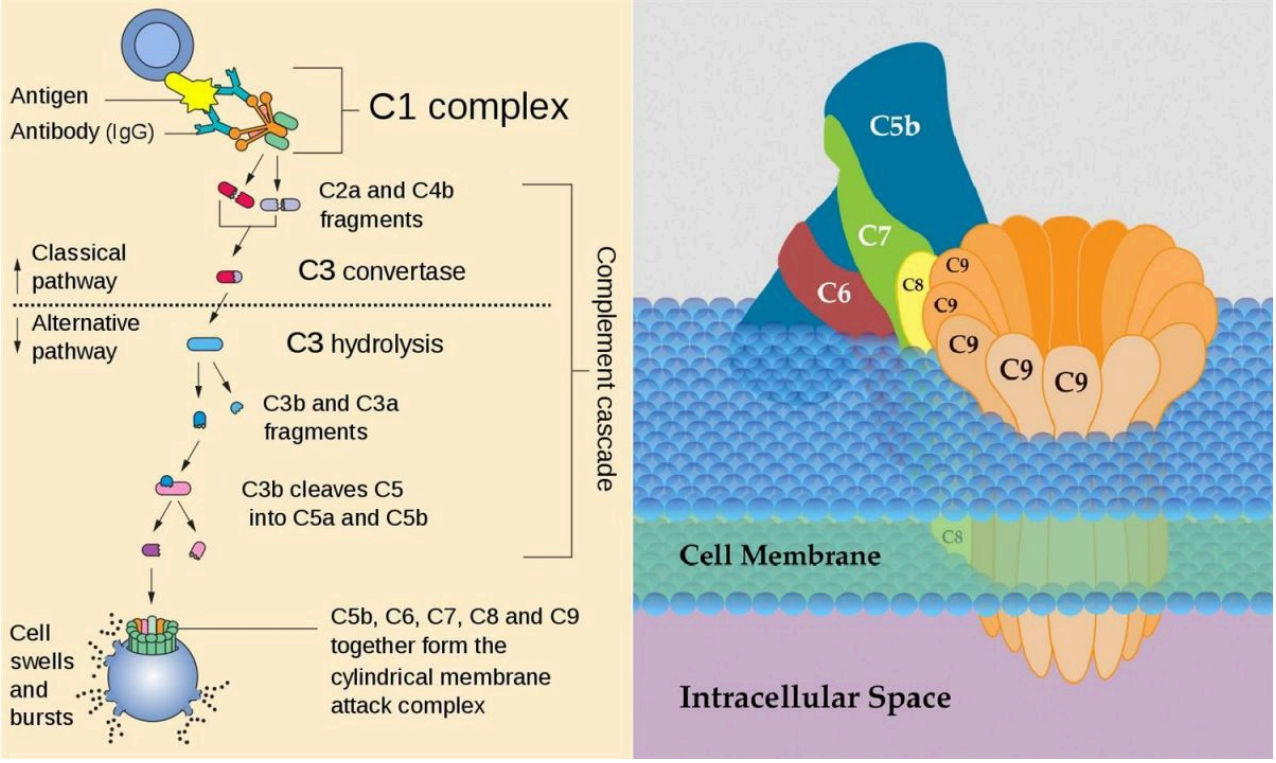
Inflammation results from changes in the circulatory system and is a general response to tissue damage and infection. There are different mechanisms to stimulate the inflammatory response, but the effect is that inflammatory chemicals, such as histamine, are released in the tissue. These chemicals cause the dilation of blood vessels which increases the flow of blood to the inflamed tissues. Inflammation also causes the junctions between the endothelial cells of the capillary wall to loosen and allow more fluid to leave the blood and enter the tissues. These changes result in the characteristic signs and symptoms of inflammation: redness, heat, swelling, and pain. The redness and heat come from the increased blood flow to the tissue. The swelling and pain come from the increased fluid accumulation in the inflamed tissues (the extra fluid puts increased pressure on pain receptors). Inflammation can protect against infection by bringing more of the protective elements in the blood, like white blood cells, to the site of the infection. It can also speed the healing process by bringing extra oxygen and nutrients to the site of tissue damage. The loose junctions between capillary endothelial cells facilitate the movement of white blood cells (and other protective substances, such as complement and antibodies described later) to exit the bloodstream and get to the site of the infection. One example of inflammation that you might not have thought of before is a sunburn. Why does the skin become so red, hot, and painful after sun exposure? The UV radiation in sunlight damages the skin and stimulates an inflammatory response. The damaged cells release inflammatory chemicals in the skin which increase the blood flow causing redness and heat. The extra fluid leaking from the capillaries will cause the skin to swell. Since large areas of the skin are swelling this sign is usually difficult to detect, but the pain is apparent, especially if extra pressure is applied to the skin.

Phagocytes

Phagocytes are specialized white blood cells such as neutrophils and macrophages that carry out the process of phagocytosis (You may click on this link to see a figure depicting Phagocytosis). As previously described, phagocytosis is a process where foreign material and pathogens are engulfed and destroyed by the white blood cells. Any potential pathogens that break through the physical barriers can be recognized and destroyed by phagocytes. Neutrophils are the most abundant type of white blood cell in the blood and will exit the bloodstream at inflamed tissues in large numbers. The accumulation of white blood cells at the site of an infection contributes to the buildup of pus at these sites. Many times, the phagocytes are effective at destroying the invading pathogens before they can cause an infection, giving us protection from disease.

Complement proteins

Complement proteins are produced by the liver and released into the blood in an inactive form. If bacteria enter the body, complement proteins can become activated to help protect us from infection. Activated complement proteins can increase inflammation and bind to bacterial cells to stimulate phagocytosis of the cells. Once bound to the bacterial cells, complement proteins can also cause the formation of pores in the plasma membrane, causing the death of the bacterial cells. This is known as the Membrane Attack Complex.



Membrane Attack Complex Using Complement Proteins.

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Fever

Fever is a natural response to many types of bacterial and viral infections. It is stimulated by chemicals released from our own white blood cells or even certain types of bacterial cells. The primary effect of a fever is to boost the efficiency of the immune system. Specifically, white blood cells become more active at fighting infections at temperatures slightly higher than normal body temperature.