

Give a brief comparison on the innate and the adaptive defence systems

1 INTROUCTION

Our living environment is heavily filled with pathogenic and non-pathogenic microbes which includes a variety of toxic and allergenic substances to pose threat to normal homeostasis by replicating, spreading, and threatening normal host functions. To recognize and destroy those abnormal cells in our body, the immune system is designed and evolved to defense against dangerous invaders such as gerns, virus, cancer cells, and organs and tissues transplanted, at the same time, they also avoid the immune system cause enormous destruction on self-tissue that might eliminate commensal microbes by detecting the mark of toxin it is distinct from host cells or the structural features of the pathogen.

The immune system is a complex protective network consist of white blood cells, antibodies, the complement system, the lymphatic system. Each of these elements is important to the immune system, particularly for bone marrow and thymus. Both bone marrow and thymus have belonged to primary lymphoid organs were to generate and multiply two main lymphocytes, which include B and T cells. Bone marrow is a spongy tissue responsible to produce all body's blood cells, including B (mature in bond marrow) and T lymphocytes(mature in thymus). Different blood cells will work together within the immune system and move to place needed to defense foreign substances in the body from the bone marrow; while the Thymus is a gland that can be found above the heart and between the lungs. The Thymus eventually will be replaced by connective tissue and fat, which only active in the stage of puberty and gradually slow down. The thymus is taking charge of producing the hormone thymosin, and thereby assist in the generation of T cells.T cells are born in the bone marrow and mature in the thymus, after multiplying in the thymus which will differentiate into helper, regulatory, cytotoxic and memory T cells with different functions such as

- 1) CD4+ helper T cells: Be helper cells to guide the immune system to attack invaders as rapidly and efficiently as possible, which also communicate with the B cells to produce antibodies.
- 2) CD8+ killer T cells: Their daily routine work is direct destroys countless cancer and virus-infected cells in the body. and equipped with the ability to distinguish the difference between foreign molecules and the body's own antigens.
- 3) Cytotoxic T cells: The cytotoxic cell is a type of white blood cell that is the main effector in the adaptive immune system and is primarily activated by cytokines, so they can kill cells that are infected with virus or bacteria, cancer cells.
- 4) Regulatory T cell: Regulatory T cell, also called Tregs, is capable of regulating and suppressing harmful cells, they are the key components help to prevent excessive immune response and autoimmune disease.

and equipped with the ability to distinguish the different between foreign molecules and body's own antigens.As T cells can identify self-structures and foreign antigens makes it become an critical elegant mechanism in immune system.Apart from the tissue and organs component of bone marrow and thymus, other components comparised in immune system also play critical role in making the system works smoothly,is capable of activating and mobililzing forces to prevent any potential harmful susbstances such as toxic or allergenic substances enter through our mucosal surface.

Before taking action to response and control the pathogen microbes, toxin and exogenous threats, it is important for immune system to initial the mechanisms of self-nonself recognition, to differntiate self from non-self, in other words, is to distinguish the antigens belong in our body from foreign anti-genes such as toxins, chemicals, drugs which may envoking the immune system called immuno-gens.The mechanisms of discrimination of self from nonself is not noly facitilite thr the process to

destroy or clear up a broad range harmful microbial cells, toxic and allergenic substances, but also to avoid these destructive mechanisms damage mammalian host's own tissue, resulting in broad class of autoimmune disorders.

Antigen, is a complex natural of protein substances that will binds particularly to a receptor molecule and made by the body's infection-fighting white blood cells(lymphocytes). Antigens with molecules can be found on several places such as virus, bacteria and fungi, sometimes located on the surface of foreign substances, such as dust and organ transplantation. A antigen may or may not stimulating an immune response, especially activating lymphocytes when it binds to a receptor molecule, even though antigens usually have diversity of three-dimensional patterns on distinct places of their surfaces and each of pattern such as an antigenic determinant, or epitope has ability to stimulate different lymphocyte receptor to multiply and initiate the an immune response, for example, the generation of antibodies or the activation of cytotoxic cells. Although the truth that some of antigens can not evoke the immune system by themselves, but still helpful in the study of immune response, as they can join with other larger and more complex protein molecules to become immunogenic. General speaking, antigens can be divide into two main divisions: foreign(or heteroantigens) and autoantigens. Foreign antigens is coming from the outside of body, there are variety of substances can be classified into foreign antigens, example include the substance generated from virus, bacterial and protozoa, some of protein in foods, the sperm and red blood cells components from other person. In contrast to foreign antigens, Autoantigens is reside within the body.

In generally, an individual without autoimmune disorders, his or her body is able to carry out the process of discriminating self from nonself by inducing the immune system to generate the autoantibodies or destroy the antigen directly, which is called an immunogen.

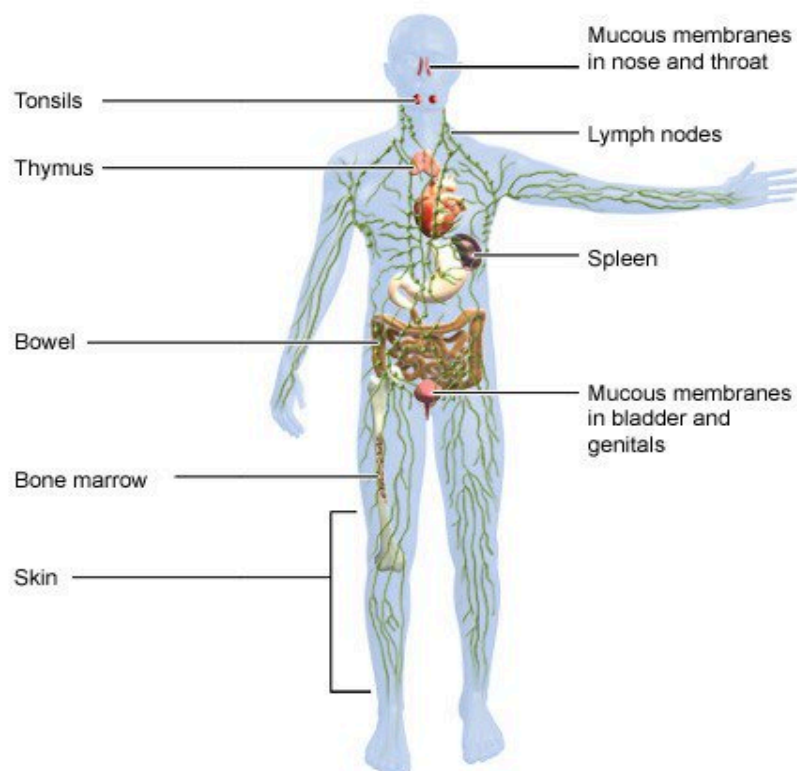


Figure 1: The 4 pillars for building a sustainable portfolio of core facilities.

2 The innate and adaptive immune systems

The immune response is made up of two parts: the innate (non-specialized) immunity and the adaptive (specialized) immunity. The innate immunity response to an invader fast acting and non-specific,

which is an immunity that a person is born with, while for the adaptive immunity which is not as immediate as innate immunity, this type of immunity is usually slow to respond to a new invader at the very beginning. Lymphocytes are the type of white blood cell (B and T cells) that take charge of the adaptive immunity, when they first encounter foreign substances (antigens), they need time to learn, adapt and remember. The components of adaptive immunity will learn the best way to attack each invader and begin to establish a memory for that invader. Thereafter, the response will be improved because the memory is formed for the past invader, so B and T cells can identify previously encountered invaders in a shortest of time, working together to destroy it even more efficiently.

People usually describe the innate and adaptive immune system as contrasting, separate arms of the host response; however, these two systems cooperate with each other and work on different tasks.

2.1 Innate defence system

The innate immune system offers a first-line barrier and non-specific response to keep potential pathogens, which include viruses, bacteria, fungi, protozoans, and worms from entering your body. It acts very quickly to prevent the transmission and movement of germs and foreign substances throughout the body. For example, the innate system will destroy a bacteria within a few hours, when it has entered the skin via a small wound. The reason why the innate system is referred to as "non-specific" immune system is that it responds in the same way to specified virus and bacterial that it recognizes. The innate immune system provides nonspecific defense protection which is made up of a number of defense mechanisms, which include Physical barriers, Chemical barriers and Cellular defenses.

- 1) Physical barriers : All outer and inner surfaces of our body are belong to the physical barriers, which is the first line of defence in fighting invasion by microbes and parasites. These include the skin and mucous membranes. Human skin include a outer layer of cell which is considered as mechanical barrier to infection. Furthermore, skin gland will secrete a variety of chemicals substances or enzyme, for example secrete oleic acid to kill bacterial or lysozyme to destroy the outer wall of bacterial. There is a variety of mucous membranes surround our body organs, to protect the body from being infected and keep those tissue moisturized by secreting mucus.
- 2) Chemical barriers: The primary function of chemical barriers such as tears, mucous and stomach acid, is to harm and destroy the invader which about to enter the internal tissues.
- 3) Cellular barriers: The cells in the innate immune system are nonspecific effector cells such as scavenger cells and natural killer cells, they will neutralize or destroy those pathogens and substances that are likely dangerous to our body.

2.2 Adaptive defence system

The adaptive defence system will become prominent defence after the first line of host defence. The second line of protection is called adaptive immunity, we also referred it as acquired immunity or specific immunity and is only found in vertebrates and will not always exist throughout an individual's entire lifespan. It is much slower to respond than the innate immune response. As the adaptive immune response is the clonal expansion of T and B cells, which takes the body time to increase the number of T and lymphocytes. However, it is more accurate and robust than the innate immune system, the adaptive immune system is able to respond faster when an individual met the same pathogen in the second time. The increased speed is due to memory cells.

2.3 Innate vs adaptive immunity

Give comparison between innate and adaptive defence system. The innate immune response is immediate with limited power to stop the spread of germs. the adaptive immune response is particularly specific, long-term (over 96 hours). In terms of the cell types involved in both of immunity are

different. In the innate immune response which includes macrophages, neutrophils, eosinophils; while for adaptive immune response are based primarily on the antigen-specific receptors of T- and B-lymphocytes.

3 CONCLUSION

The immune system consists of many components such as cellular components, molecular components to protect us from a universe of pathogenic microbes. Understanding the function of different components will allow for improvement in vaccines, immunomodulatory therapeutics as well as avoidance of unexpected tissue injury.