Immunology practical session 1 correction

- **Immunity** refers to the **defense mechanisms** of a living organism against foreign agents, particularly infectious ones, or internal threats such as tumor transformation, which may **endanger its proper functioning** or survival.

- The organs, tissues, cells, and molecules that contribute to resisting infections is called the **immune system**. The lymphoid organs and tissues are distributed throughout the body, and cells circulate within and between these organs via blood and lymph.

- **Cells communicate with each other either through direct contact** (receptor-ligand concept) or **remotely** through secreted molecules (receptor-mediator concept). These secreted, soluble molecules are called **cytokines**. This generic term includes lymphokines, monokines, and chemokines. Some are also referred to as interleukins, for which there is an international nomenclature. **The coordinated reaction of these cells and molecules is called the immune response.**

- **Physiologically**, the immune system plays a crucial role in preventing infections, eradicating established infections, and inhibiting tumor proliferation. The body has two defense systems: ****innate immunity** and **adaptive immunity**.**

- **Innate immunity**, also called **natural immunity**, corresponds to a constitutive response with immediate action, **non-adaptive**. It relies on a broad distinction between self and non-self. Innate immunity is based on **humoral** mechanisms (complement system, cytokines, acute-phase proteins of inflammation, etc.) and **cellular** mechanisms (phagocytic or lytic cells such as polymorphonuclear cells, natural killer cells or NK cells, macrophages, etc.). Its activation constitutes the **inflammatory response**.

- **Adaptive immunity** or **acquired immunity**, which is slower to develop, appears later. This response is **specific** to the antigen because the cells of adaptive immunity, the lymphocytes, carry a single type of receptor capable of recognizing an antigenic determinant (also called an epitope). B lymphocytes can recognize epitopes in their native form, while T lymphocytes recognize epitopes as peptides and only when presented by major histocompatibility complex (MHC) molecules. The adaptive response is time-limited to the eradication of the aggressor and retains memory of it. Its recognition

of self is limited, particularly because during their development in **primary lymphoid organs**, most adaptive immune cells recognizing self-antigens are eliminated.

The immune response is triggered because the immune system receives **"danger" signals**, and certain cells can recognize molecular patterns associated with pathogens (Microbe-Associated Molecular Patterns or MAMPs) or danger signals (Danger-Associated Molecular Patterns or DAMPs) through a set of receptors (Pathogen Recognition Receptors or PRRs). Meanwhile, other cells of the adaptive immunity recognize molecules or **antigens** identified as foreign to our body, called **non-self antigens**, through a receptor specific to each cell.

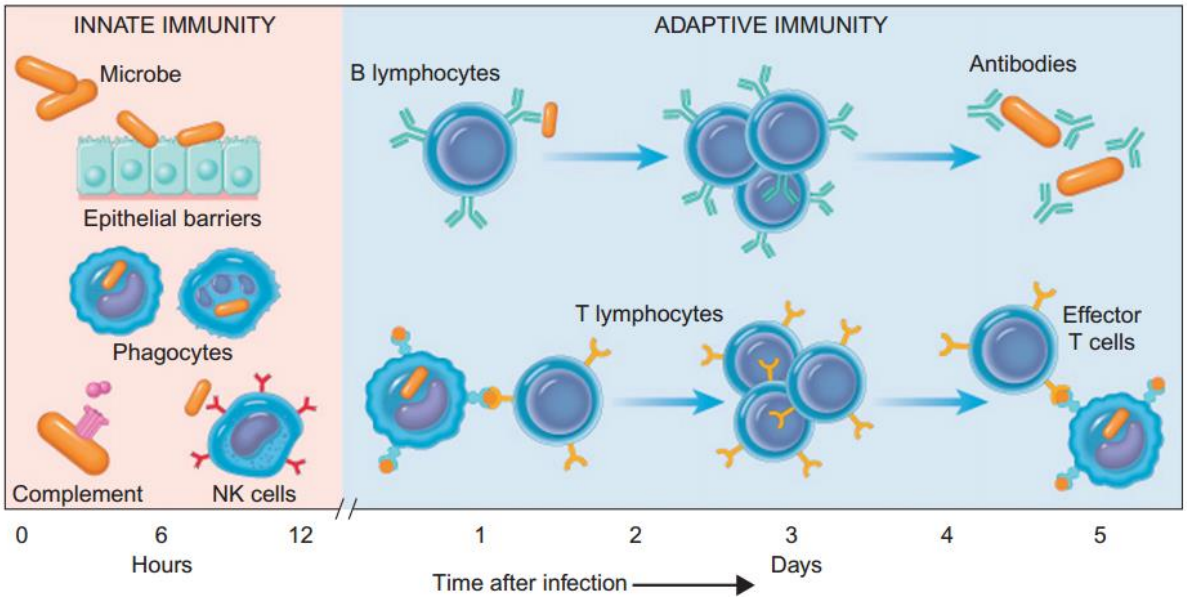

Figure 1: Main mechanisms of innate and adaptive immunity. The mechanisms of natural immunity provide the initial defense against infections. Some mechanisms prevent infections (e.g., epithelial barriers), while others eliminate microbes (e.g., phagocytes, NK cells, and the complement system). Adaptive immune responses develop later and are mediated by lymphocytes and their products. Antibodies block infections and eliminate microbes, and T lymphocytes eliminate intracellular microbes. The kinetics of innate and adaptive immune responses are approximations and may vary depending on the infection.

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Recognition Receptors or **PRRs**). Meanwhile, other cells of the **adaptive immunity** recognize molecules or **antigens** identified as foreign to the body (called **non-self antigens**) via a receptor specific to each cell.

This immune response, **which occurs in secondary lymphoid organs**, is the result of the first encounter between naïve lymphocytes and the antigen. A secondary response occurs upon subsequent exposures to the same antigen. This response is faster, stronger, and longer-lasting to eliminate the antigen. The secondary response results from the activation of memory lymphocytes. These long-lived cells were induced during the primary response. Memory optimizes the immune system's ability to combat persistent and recurrent infections. Memory applies to both B and T lymphocytes. The principle of vaccines is based on the concept of memory.

- During the immune response, there is close interaction between innate and adaptive immunity. **Antigen-presenting cells (APCs)**, which participate in the innate response, will, after activation and maturation, present antigens degraded into peptides to T lymphocytes. Additionally, **there are many cellular cooperations between B and T lymphocytes to achieve an effective humoral response and between CD4 and CD8 T lymphocytes to achieve an effective cellular response.**
- **An antigen** is a molecule of any nature (organic or not) that can be recognized by an antigen receptor of adaptive immunity. These receptors are of two types: the B-cell receptor (BCR) and the T-cell receptor (TCR). In reality, we produce several million different molecules of each of these two types. The binding property of the antigen to these receptors confers its antigenicity. Only antigens that provoke an adaptive immune response are termed immunogens.

- **Haptens** are non-immunogenic antigens; they include heavy metal salts (nickel, chromium, mercury), plant quinones, synthetic molecules (drugs, dyes, etc.), or natural molecules (peptide or steroid hormones). These substances, with a molecular weight below 1 kDa, have antigenic properties but are not immunogenic. They become immunogenic when stably coupled to an immunogenic carrier molecule. The development of allergies to haptens requires such coupling.