Immunological Synapses in Infectious Diseases

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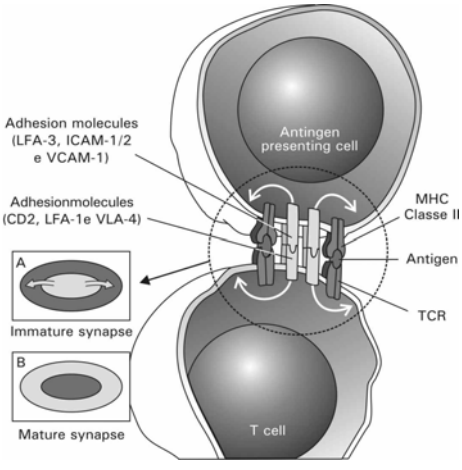
The first conceptualization that the immune system (IS) could possess a communication mechanism analogous to the chemically-mediated neuronal synapses was developed by Norcross in 1984 [1]. In 1988, the observation that the T lymphocytes are capable of releasing cytokines in a specific direction – or, from a specific membrane region – allowed he revisiting of the notion of a synapse. The synapse was subsequently defined based on the intimate contact between two cellular surfaces, promoted by the binding of proteins present in both membranes [2]. Finally, in 1995, experimental results related to the interaction between cells of the IS were presented, demonstrating that the cellular membrane surface proteins of the interacting cells are organized following a pattern resembling a target in the contact region between the cells [3]. This notion was accepted until the consolidation of the idea of an immunological synapse, characterized as the transitory union between cells of the IS for the purpose of recognition, enabled by the 'shifting' of surface proteins to the interaction site.

An immunological synapse has been demonstrated among different cell types, including lymphocytes, antigen-presenting cells and natural killer cells, among others. Its organization is based on the disposition of proteins in the cell membranes, which dislocate to the interaction surface. The movement of these proteins is fundamental for synapse formation, especially because their respective spatial situations are altered during cellular communication. At first, recognition proteins are disposed around adhesion molecules (intracellular adhesion molecule-1/lymphocyte function-associated antigen-1, ICAM-1/LFA-1), characterizing an immature synapse. This disposition is later inverted so that the recognition proteins are found in the synapse's central region, surrounded by the adhesion proteins – characterizing a mature synapse (Figure 1) [4]. The movement of these proteins depends on the integrity of the cytoskeleton. However, other factors may also be involved.

A complete understanding of the interaction between the immune cells is one of the main requirements for the elucidation of the functional aspects of the IS, bringing new possibilities for a comprehension prioritizing a complexity-based ecological vision, in detriment of the classic bellicose concept of immunology. Moreover, there is a broad horizon of applicability of this knowledge in the different human illnesses. In fact, the role of the immunological synapse has been studied in the autoimmune diseases, acute myeloid leukemia, Burkitt's lymphoma and in organ transplant rejection, but, specially, in infections by HIV and HTLV-1 retroviruses [5,6]. Within the next few years, it is hoped that these investigations can bring significant contributions to the diagnosis and treatment of these disorders, increasing the curative possibilities of infectious disease medicine in the XXI century.

Figure 1. Organization of the mature immune synapse.



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