Immune Synapse Encyclopedia Article

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Before they can help other immune cells respond to a foreign protein or pathogenic organism, helper **T cells** must first become activated. This process occurs when an antigen-presenting cell submits a fragment of a foreign protein, bound to a Class II **MHC** molecule (virus-derived fragments are bound to Class I MHC molecules) to the helper T cell. Antigen-presenting cells are derived from bone marrow, and include both dendritic cells and Langerhans cells, as well as other specialized cells. Because T cell responses depend upon direct contact with their target cells, their **antigen** receptors, unlike antibodies made by **B cells**, exist bound to the membrane only. In the intercellular gap between the T cell and the antigen-presenting cell, a special pattern of various receptors and complementary ligands forms that is several microns in size. This patterned collection of receptors is called the immune synapse.

The immune synapse can be compared to a molecular machine that controls T cell activation. Physically it consists of a group of T cell receptors surrounded by a ring of integrin-like adhesion molecules as well as other accessory proteins like the CD3 complex. Integrins are a family of cell-surface proteins that are involved in binding to extracellular matrix components. This specialized cell-cell junction was named the immunological synapse because it is thought to be involved in the transfer of information across the T cell-APC junction. Specifically, the immune synapse appears to play an essential role in organizing the immune response, the level of control, and the nature of that response. The formation of the synapse requires several minutes and it appears to be stable for several hours. The structural protein actin seems to have an important role in that stability as T-cell activation is blocked by disruption of actin filaments. There also appears to be a temporal spatial component in that signals that modulate T-cell maturity and functions are received in a serial manner as well as simultaneously. Further clarification of the structure of the immune synapse will help develop further insights into T cell recognition as well as the mechanism of T cell receptor signaling - how information transfer occurs across the synapse. The duration of signaling in immature T cells may control CD4 and CD8 lineage decisions. This would be useful in determining the degree to which different types and developmental stages rely on alternative signaling mechanisms.