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Commentary

Role of Cytokines in Immune Response and Inflammation

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DESCRIPTION

Immune systems are intricate. Different immunological cell and protein subtypes carry out various functions. One of the proteins is cytokines. To comprehend inflammation, they need to understand the role that cytokines play. Cytokines are released by cells either straight into tissues or into the bloodstream. Immune cells are where cytokines localize, target, and attach to their receptors. The target cell's reaction is elicited or stimulated by this interaction. Cytokines are small, non-structural proteins with low molecular weight that have intricate regulatory impacts on immune response and inflammation. Long believed to be mediated by cytokines, hematopoietic cells, lymphoid cells, and different pro-inflammatory and anti-inflammatory cells are involved in the development of immune and inflammatory responses. Cytokines are immune system intercellular messengers that integrate the functions of numerous cell types in distinct body compartments into a coordinated immune response. Interferon, interleukins, chemokines, mesenchymal growth factors, tumor necrosis factor family, and adipokines have all changed over time.

Every cell produces cytokines, with the exception of red blood cells, which do not respond to them. Cytokines are released by a variety of cells, including white blood cells, in response to different stimuli. The distinguishing feature of a cytokine is pleiotropism, and cytokines and similar substances have had mixed results when used as therapeutic agents. Specific receptors for signal transmission and regulatory action are present on the target cell's membrane.

Cytokines serve critical roles in a wide range of processes, including tumorigenesis, angiogenesis, neurobiology, innate and adaptive immunity, inflammation, and viral etiology, in addition to their roles in innate and adaptive immunity. Cytokines are now extending their range of applications to include atherosclerosis and cancer in addition to inflammation, immunity, and infection. As such, cytokines are valuable biomarkers for both health and illness and can be used for therapeutic, prognostic, and diagnostic purposes.

The development of cytokines has revealed them to be soluble substances produced by one cell and acting on another, creating cytokine activity. It quickly became evident that activation by an antigen or non-specific mitogen could control the production of these factors. The first two cytokines to be given names were Interleukin-1 (IL-1) and Interleukin-2 (IL-2). A standardized nomenclature was also created to designate cytokines as interleukins in relation to their role among leukocytes. T-cell lymphoma was chosen to produce IL-2, and leukemic monocyte cells were chosen to produce IL-1. Some cytokines may not be expelled from cells; they are now understood to be essential membrane proteins. Knowledge advancements have brought attention to cytokines' complexity and biphasic character. The identical molecule can have both advantageous and disadvantageous consequences. Interferon gamma, which is crucial for defense against some intracellular microorganisms like *Mycobacterium tuberculosis*, is just one example of a cytokine that plays a significant role in the pathogenesis of some autoimmune disorders. Many vaccines are based on IL-2, which is necessary for the development of cytotoxic T cells, but the same cytokines also result in graft-*versus*-host disease and reduce the effectiveness of bone marrow transplants.

The receptors found on the membranes of responsive target cells allow the cytokines to perform a variety of biological effects. These receptors have a solitary membrane-spanning domain, an extracellular domain, and a cytoplasmic domain. The extracellular domain contains conserved amino acid sequence patterns, which include four conserved cysteine residues. Additionally, there are two polypeptide strands present. One is a cytokine-specific component, and the other is a subunit involved in signal transduction. The presence of particular membrane receptors dictates the type of target cell to which the cytokines attach. In addition, cytokines frequently trigger the production of other cytokines, causing a cascade of events in which the latter cytokines affect the activity of the former cytokines that released them. Finally, because of their brief half-lives in the bloodstream and extracellular fluids, they only work for a very short duration. Inflammatory and neuropathic pain is both influenced by pro-inflammatory cytokines.

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