**Cytokines and its relation to Autoimmune diseases and immunotherapy for Cancer**

Author: Aneisha White
Major: Microbiology
Department of Microbiology and Molecular Genetics, Oklahoma State University, Stillwater, OK 74078, USA

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**Autoimmunity plays a major role in prevalent diseases like rheumatoid Arthritis, lupus, and Vitiligo. The immune system has innated and adaptive responses towards antigens and pathogens. When the body fail to recognize between self and pathogens, it can lead to an array of issues such as inflammation, organ failure, and tissue damage. Cancer is another consequence of the lack of check and balance brought on by the immune system. The relation between these two conditions lies within the molecular biology of the immune system one example in particular, Cytokines. Cytokines are signals sent between immune cells which can help with the production of antibodies brought on by T-cell receptors and B cells. The immune system does a near perfect job with distinguishing between oneself. However, through the adaptive immune system, there can be a mistake in distinguishing between the two, thus sometimes resulting in the production of cytokines that lead to tissue damage and inflammation. (**M. Kostine,). **It Is imperative for the immune system to keep the use of cytokines extremely in check. Conversely, the use of cytokines in cancer treatments has been a breakthrough for treating certain cancers like melanoma and Renal Cancer. Utilizing the body’s immune system to treat cancer is a hallmark of immunotherapy, However, the way immunotherapy effects the immune system results in responses that are very similar to autoimmunity. Cytokines may be the correlation to how Cancer is treated with immunotherapy and the pathogenesis of autoimmune diseases.**

**Introduction**

Cytokines play a role in regulating the innate and adaptive immune system by allowing immune cells to communicate and interact with one another. Cytokines can be pro-inflammatory and anti-inflammatory depending on what is causing the immune response. Cytokines all share similar roles and can lead to the same response triggered by different cells. Cytokines are known to act as a cascade by interacting with one cell that eventually interacts with another cell. Furthermore, through Cytokines, cells such as T cells and B cells can induce factors that regulates immune responses. The direct cause of autoimmunity is unclear. However, genetics and environmental factors are evidently known to be a trigger for the mishap in the adaptive immune system. Like autoimmunity, Cancer is link with genetics and one’s environment yet instead of the adaptive immune system’s lack of distinguishing between self and non-self-antigens, the onset of cancer is abnormal cell growth mostly brought on by a multitude of mutation in genes. There are pathways and interactions., that act as defenses against abnormal cell growth such as tumor suppressor genes, which regulate cell growth. When a tumor suppressor gene is mutated, it can lead to uncontrollable cell growth and eventual malignant tumors. Cancer remains to be one of the leading causes of death in the world. Therefore, the research for treatment is always prevalent. Because of research, breakthrough treatments like chemotherapy and the most recent, immunotherapy continues to be successful in treating and preventing more spread in Cancers. The usage of certain cytokines is one of the types of immunotherapeutic treatments being utilized. Interferon alpha is a cytokine used to treat cases of melanoma and renal cancer; Some cytokines are inducers of T-cell receptors. T-cell receptors have several roles: for example, preventing autoimmunity and anti-tumor growth for vaccines. In this article, the pathogenesis of cancer and autoimmunity will be highlighted and how both are related to Cytokines.

**The pathogenesis of Autoimmunity and Cytokines**

The Adaptive and Innate immune system are both responsible for the destruction of pathogens. The adaptive Immune system while extremely, affective takes some time to begin mechanisms that recognize and bind to antigens, While the innate immune system is imprinted into the genome to quickly recognize and properly handle antigens. Antigens are proteins recognized by T cells and B cells that induces the production of antibodies. These antibodies work to inhibit cells from proliferation and eventual destruction by macrophages. These are a series of mechanisms such as the production of complements and molecular reactions that result in some effects such as inflammation and more stimulation of the immune system (Valencia, J.) Because of how these mechanisms work, like the start of apoptosis, it is important for the immune system can recognize antigens that are pathogenic, and antigens produced by the body. Cells that cannot distinguish are usually discarded, however, in the adaptive immune system, the production of autoantibodies, antibodies that are produced to bind self-antigens, can cause mechanisms and inhibitions that result in inflammation, destruction of healthy tissue and cells, and loss of function in organs.

The pathogenesis of autoimmune diseases can occur from multiple mechanisms. Leading to different markers being tested to specify the autoimmune disease. Cytokines play a vital role in the pathogenesis of autoimmunity, based on the signaling between T-cell receptors, low or high levels of cytokines can lead to inflammation markers and the production of autoantibodies (Moudgil, K. D.,) The direct cause autoimmunity is unknown, but like Cancer, mutations in genes over an expanded period can lead to the onset.

**Recent Progress**

Immunotherapy is recent forms of treatment being used for cancer. The research of interferons as treatment have had results in showing how higher levels of INF can lead to regression of tumor growth by increasing the efficacy of the effector cells. (Borden, E.C.).

**Discussion**

While pro-inflammatory cytokines can lead to autoimmune responses, the immunotherapeutic properties of cytokines for treating cancer is also known. Creating a paradigm effect pertaining to cytokine levels of both autoimmunity and tumor cell growth. Recent research are being conducted regarding the efficacy of immunotherapeutic treatment in individuals with autoimmune diseases. Increased levels of certain interferons can reduce tumor cell growth in certain Cancer, though the change in gene expression of cells because of higher levels of interferon and how it can affect the pathogenic effect of autoimmunity still remain unknown.

**References**

Jonathan Pol, Juliette Paillet, Céleste Plantureux & Guido Kroemer (2022) Beneficial autoimmunity and maladaptive inflammation shape epidemiological links between cancer and immune-inflammatory diseases, OncoImmunology, 11:1, DOI: [10.1080/2162402X.2022.2029299](https://doi.org/10.1080/2162402X.2022.2029299)

M. Kostine, L. Chiche, E. Lazaro, P. Halfon, C. Charpin, D. Arniaud, F. Retornaz, P. Blanco, N. Jourde-Chiche, C. Richez, C. Stavris,

Opportunistic autoimmunity secondary to cancer immunotherapy (OASI): An emerging challenge,

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2017,

Pages 513-525,

Collison, L. W., Workman, C. J., Kuo, T. T., Boyd, K., Yao Wang, Vignali, K. M., Cross, R., Sehy, D., Blumberg, R. S., & Vignali, D. A. A. (2007). The inhibitory cytokine IL-35 contributes to regulatory T-cell function. *Nature*, *450*(7169), 566–569. https://doi-org.argo.library.okstate.edu/10.1038/nature06306

 Valencia, J. C., Egbukichi, N., & Erwin-Cohen, R. A. (2019). Autoimmunity and Cancer, the Paradox Comorbidities Challenging Therapy in the Context of Preexisting Autoimmunity. *Journal of interferon & cytokine research: the official journal of the International Society for Interferon and Cytokine Research*, *39*(1), 72–84. <https://doi.org/10.1089/jir.2018.0060>

 Borden, E.C. and Sondel, P.M. (1990), Lymphokines and cytokines as cancer treatment.Immunotherapy realized. Cancer, 65: 800-814. [https://doi.org/10.1002/1097-0142(19900201)65:3+<800::AID-CNCR2820651328>3.0.CO;2-Y](https://doi.org/10.1002/1097-0142%2819900201%2965%3A3%2B%3C800%3A%3AAID-CNCR2820651328%3E3.0.CO;2-Y)

 Moudgil, K. D., & Choubey, D. (2011). Cytokines in autoimmunity: role in induction, regulation, and treatment. *Journal of interferon & cytokine research: the official journal of the International Society for Interferon and Cytokine Research*, *31*(10), 695–703. https://doi.org/10.1089/jir.2011.0065