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Review of Growth Factors and Cytokines in Health and Illness Frontier Immunology

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Abstract

In signaling cascades that control cell survival, adhesion, proliferation, and migration, cytokine and growth factor receptors such as receptor tyrosine kinases (RTKs), Toll-like receptors, and G-protein-coupled receptors (GPCRs) are essential players. A number of these receptors are being looked into as significant therapeutic targets because they are also heavily engaged in the growth and development of numerous disease-related cells. Therefore, it is anticipated that precise investigation of their actions will aid in the development of new medications and medical diagnoses. The dynamic behaviours of cytokine and growth factor receptors in living cells, such as lateral mobility on the cell surface, internalisation, and recycling, are closely tied to both their activities and changes in the corresponding ligand-dependent signals. Therefore, trustworthy methods are urgently needed for imaging these receptors in live cells. Reactive cytokines and growth hormones can be used to specifically mark membrane receptors. Reactive cytokines and growth factors can be handled easily and adaptably using a supramolecular method. Endogenous membrane receptor dynamics are imaged in real-time.

Keywords: Endogenous; Supramolecular; Eosinophils; Immunity

Introduction

Eosinophils, granulocytic white blood cells that are uncommon in healthy people, are raised in the blood and tissue compartments during allergic inflammation and late-onset chronic eosinophilic asthma, among other helminthic parasite infections [1]. Healthy people typically produce few eosinophils from their bone marrow, which leads to a small number of cells circulating throughout the body. The majority of the eosinophils that are produced in a healthy bone marrow are found in the gut mucosa, where they may help the gut bacteria maintain homeostasis. In a variety of distinct inflammatory and allergy responses, blood and tissue eosinophil counts are significantly changed, and eosinophils can be seen in high concentrations in mucosal tissues [2].

There are two classes of CD4+ T cells that are involved in the start and maintenance of the allergic response, and several regulatory cytokines have been identified as belonging to both classes. The first category of cytokines includes interferon- (IFN), interleukin-2 (IL-2), and IL-12, which are produced by T helper 1 (Th1) cells. Th2 cells produce the second set of cytokines, which includes IL-4, IL-5, IL-9, and IL-13. By producing immunosuppressive or regulatory cytokines like IL-10 and IL-17, Th17 and Treg cells may also have a role in the regulation of allergic reactions, according to more recent studies [3]. In light of the fact that IL-25 and IL-33 have a strong connection with asthma in more recent studies, these cytokines may play a significant role in the onset of allergic reactions [4].

Growth factors, cytokines, and chemokines in asthma and allergic inflammation

Eosinophils continue to have a mysterious role in immunity [5]. Numerous invertebrate species, including crustaceans, insects, mammals, fish, and birds, as well as vertebrates, share these granulated white blood cells to varied degrees. Their widespread expression across so many species raises the possibility that they have a crucial and evolutionarily conserved role in immunity [4,5]. However, the exact nature of this involvement is currently being closely examined. While eosinophils have long been thought to have a role in the upkeep of immunity against helminthic parasites, current research in transgenic mice lacking eosinophils points to a more nuanced function for these cells than was previously recognised. Contrary to the widely held belief that eosinophils may be protective against helminthic parasites, in some situations, the absence of eosinophils actually decreased parasitic growth [5,6].

Result

The presence of an altered immune response, which is brought on by an imbalance between Th1/Th17 and Th2-driven responses, which constitute a key etiological factor, is a common feature of many dermatological illnesses [7,11]. A novel approach to treating these disorders might involve reversing the immunological imbalance brought on by this altered cytokine profile [6,8]. We took advantage of the coordination chemistry between a His tag fused to the cytokine or growth factor and Ni(II)-NTA with DMAP (DMAP-Ni(II)-NTA) in order to create DMAP-conjugated cytokines and growth factors without losing any of the cytokine or growth factor function [9,10]. This method was thought to have minimally negative effects on the structure and function of cytokines and growth factors because to the widespread usage of His tags for the purification of cytokines and growth factors and the commercial availability of a variety of His tag-fused cytokines and growth factors [11-14].

Conclusion

With the help of non-covalent interactions between the His tag and the Ni(II)-NTA moiety, we were able to successfully design and build a number of supramolecular DMAP-conjugated cytokines and

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growth factors. These molecules serve as a tool for the selective covalent labelling of endogenously expressed membrane receptors on the surface of living cells. This straightforward, adaptable supramolecular method may easily produce several DMAP-conjugated cytokines and growth factors without any purification. It is also possible to use this method to track the dynamics of endogenous receptors in living cells after stimulation with various ligands, emphasising the usefulness of this approach for real-time functional analysis of membrane receptors. More specifically, this method allowed us to visualise endogenous membrane receptors, such as EGFR or CXCR4, without any loss of activity in a specific manner on live cells.

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None

Conflict of Interest

None

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