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Introduction

Cancer therapy has witnessed significant advancements in recent years, with immunotherapy emerging as a promising approach for

Cytokines are signaling molecules that play crucial roles in regulating immune responses and inflammation. Cytokine gene transfer involves the introduction of genes encoding specific cytokines into target cells, such as tumor cells or immune cells, to enhance their anti-tumor activity. By expressing cytokines locally within the tumor microenvironment, this approach aims to amplify immune responses against cancer while minimizing systemic toxicities [2,3].

Mechanisms of action

Cytokine gene transfer exerts its effects through various mechanisms, including:

Immune cell activation:

Cytokines such as Interleukin-2 (IL-2) and Interleukin-12 (IL-12) stimulate the proliferation and activation of cytotoxic T cells and Natural Killer (NK) cells, enhancing their ability to recognize and kill cancer cells [4].

Anti-tumor immune response:

distribution within the tumor microenvironment. Additionally, personalized approaches based on the genetic and immunological pro les of individual patients may help tailor cytokine gene transfer strategies for optimal therapeutic outcomes [10].

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Cytokine gene transfer represents a powerful tool in the arsenal of cancer therapy, o ering a targeted and immunomodulatory approach to combat malignancies. By harnessing the genetic power of cytokines, researchers aim to amplify anti-tumor immune responses and overcome the immunosuppressive barriers within the tumor microenvironment. While challenges remain, ongoing research e orts and technological advancements hold the potential to unlock the full therapeutic potential of cytokine gene transfer, paving the way for personalized and e ective treatments for cancer patients.

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