Novel Immunotherapy for Cancer

Case Number: ID 965

Background
The immune system is a powerful tool in the fight against cancer because it can be taught to recognize and kill cancer cells. Very specific changes occur in cancer progression, and these changes can be targets for immune cells. One of these changes is on a cell surface glycoprotein called Mucin 1 (MUC1). Changes in MUC1 expression have been shown to be associated with 80 percent of epithelial tumors. These tumors include but are not limited to lung, prostate, colorectal, breast, pancreatic, and ovarian cancers. MUC1 changes are also present on lymphomas and multiple myelomas.

Technology Description
This invention provides an isolated nucleic acid encoding a T cell receptor (TCR) that binds to MUC1 on the surface of the tumor cell, independent of MUC1 antigen presentation by the major histocompatibility complex (MHC). Current cancer immunotherapy targets immune responses against antigens that are presented by specific MHC molecules, limiting the efficacy of the therapy to patients who express the particular MHC molecule. This non-MHC restricted MUC1 TCR therefore represents a potentially efficacious immunotherapy approach that can be used both in conjunction with traditional cancer treatments or as an alternative treatment if traditional therapy fails.

This is particularly important in patients with late-stage disease who have failed other therapies and have fast-progressing tumors and disseminated metastases. T cells can be isolated from peripheral blood of these patients and modified to express this receptor. These T cells can be reinfused to go to the site of tumors and kill tumor cells. Alternatively, instead of only T cells, all blood cells can be used. The receptor is constructed in such a way that it is capable of expression in multiple immune cell types. This is important because different immune cell types have different tumor-destroying mechanisms, thus not allowing tumor cells to escape.

This technology is also useful in patients undergoing bone marrow or stem cell transplant for breast cancer: T cells or all immune cells could be taken before high-dose chemotherapy, modified with the receptor and stored in the freezer. They can be infused together with the stem cell product to control tumor growth during immune reconstitution, when patients are completely immunocompromised and the tumor can have the advantage of uncontrolled growth.

Applications
Cancer immunotherapy for:
- Solid tumors
- T cell and B cell lymphomas
- Multiple myelomas

Advantages
- Can be used to supplement traditional treatment
- TCR can be expressed in many immune cell types
- Will not pair with other TCR (T-cell receptors)
- Can be used in all patients, regardless of MHC type
- Can be used at any stage of cancer progression, especially late stage in those patients who would not qualify for other approaches such as vaccination
- Will treat more than 80 percent of all cancer tumor types
- Product is nontoxic; normal tissues are not affected
- Treatment can be enhanced with MUC1 vaccine (U.S. patent 5,744,144 and U.S. patent 5,827,666 issued to the University of Pittsburgh)

Stage of Development
- Animal models

Patent Status
Nonprovisional Patent Application Filed
U.S. Patent Application 20060263334
Therapeutic and Diagnostic Cloned MHC-unrestricted Receptor Specific for the MUC1 Tumor-associated Antigen

Inventor
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Olivera Finn, professor and chair of the University of Pittsburgh Department of Immunology, has been the leader of the University of Pittsburgh Cancer Institute (UPCI) immunology program since 1991, the year she became a faculty member at the University of Pittsburgh School of Medicine.

**Awards and Achievements**
- American Cancer Society Faculty Award
- UPCI's Scientific Leadership Award
- University of Pittsburgh Chancellor's Distinguished Research Award
- University of Pittsburgh Mentor of the Year Award
- Department of Molecular Genetics and Biochemistry Faculty Award

**Professional Organizations**
- President, American Association of Immunologists
- American Association for Cancer Research (AACR)
- Women in Cancer Research
- AACR task force on immunology

**Research Interests**
Finn's research interests and expertise are in the areas of tumor immunology, transplant immunology, and T-cell biology. In particular, her group has identified a novel immune response to a tumor-associated antigen, MUC1, expressed on breast, pancreatic, colon, ovarian, and other carcinomas of epithelial cell origin. This work has led to the development of a potential cancer vaccine based on MUC1 that is being tested in clinical trials.

**Publications**


