

# Immunotherapy: A New Era Of Treating Cancer

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**Abstract:** the purpose of this research is to identify the new era of treating cancers, known as immunotherapy, Immunotherapy is a cancer treatment which uses a patient's own body cells to fight the cancerous cells. The first part of this paper identifies what this treatment is, as well as the pros and cons. The second part talks about the different types of immunotherapy, how they can affect the body, and the way each variation of the treatment works. By perfecting the process of immunotherapy, we can direct future research on a cure for cancer.

**Index Terms:** Cancer, Cancer cells, Cancer treatment, Immune system, Immunotherapy, Metastasis, Side effects, Vaccines

## 1 INTRODUCTION

Cancer, one of the most widely spread forms of disease, is slowly taking over the world. It is a form of disease involving the abnormal proliferation of cells in various parts of the body. Some people are fortunate enough to undergo only one treatment while others with a more progressive form have to undergo many. There have been several treatments to reduce the metastasis, or the spreading, of cancer cells. However, no treatment is proven to completely obliterate cancer cells in a human body. Immunotherapy is a process which involves the use of one's own immune system to counteract the effects of various diseases, including cancer. Immunotherapy was first used in the 19<sup>th</sup> century, but has developed to this day, and continues to do so. The main types of this treatment include monoclonal antibodies, cancer vaccines, immune checkpoint inhibitors, and other non-specific therapies. In the past few years, immunotherapy has become important in reducing the effects of cancer and will continue to show progressive results as more research is conducted.

### 1.1 Purpose of this research

Immunotherapy is a much more beneficial way of treating cancer than other conventional therapies, as it reduces the health risks and problems that most treatments cause. As it is a natural treatment, it helps improve your immune system and body. This can help you in the future, preventing cancer from recurring. In this paper, I will describe this new era of treating cancer. I will explain the process of immunotherapy, the ways it's used, and why it is more beneficial than other cancer treatments.

### 1.2 Brief history

Immunotherapy was first attempted in 1891, by William B. Coley, MD, who is often known as the "Father of Immunotherapy." He used live and inactivated bacteria, injected into patients' tumors, which achieved remission in several types of malignancy.

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Noting this, he began to inject mixtures of live and inactivated viruses into the tumors of patients in 1891. However; this was avoided by other oncologists, due to the risk of deliberately infecting patients with pathogens. Immunotherapy became prominent again in 1957, when Thomas and Burnet proposed the theory of cancer immuno-surveillance. However, the absence of data and the inability to manipulate blood cells postponed progress for some time.

### 1.3 What can immunotherapy treat now?

The process of immunotherapy is continuously imp. However, the PD-1 inhibitors used for this treatment can currently treat melanoma, kidney cancer, bladder cancer, head and neck cancers, non-small-cell lung cancer, and Hodgkin's lymphoma.

## 2 BODY

Immunotherapy was first used over 100 years ago, by William B. Coley. He noticed that patients with cancer went into spontaneous remission after developing erysipelas. He began injecting mixtures of live and inactivated streptococcus pyogenes and serratia marcescens into patients' tumors, thus creating the first cancer vaccine. Since then, scientists have been studying the relationship between the immune system and cancer. However, immunotherapy still needs to be researched and developed.

### 2.1 What are the pros and cons of immunotherapy?

Conventional cancer treatments such as radiation therapy and chemotherapy expose humans to harmful radiation. This radiation damages healthy cells as well, which causes side effects. Immunotherapy avoids that risk, while still having the same result.

#### Pros:

Immunotherapy takes advantage of the human immune system, which helps fight disease and maintain wellbeing. It uses substances made by the body, or in some cases, in a laboratory, to improve or restore the immune system's function. This allows patients to avoid most side effects, as this process only targets your immune system, and not all cells in your body. Immunotherapy can either help the immune system work better at destroying cancerous cells, or stop/slow the growth of these cells. Cancer treated by immunotherapy is also less likely to return, as the immune system learns to go after cancer cells if they ever come back. This process is known as immune memory.

#### Cons:

However, as with all cancer treatments, there are a few risks. In fact, many of the drugs used for immunotherapy are linked to severe side effects, such as infusion reactions, flu-like

symptoms, rashes, and severe diarrhea. Other side effects include heart palpitations, swelling, and itching. Also, since the therapy affects the immune system, some have caused serious auto-immune reactions. This means that the body literally starts to attack its own organs, like your heart, liver, lungs, intestines, or kidneys. Another problem with immunotherapy is that it only works for less than 50% of the people who try it. Many people only have a partial reaction to this treatment. Also, continual treatment may cause the drug to stop having an effect on your cancer cells. This means that even if the process works at first, your tumor could start growing again. Another disadvantage is that immunotherapy is a slower process than other treatments, so the cancer cells will not go away quickly.

## 2.2 Types of immunotherapy

Over the past few years, immunotherapy has evolved and changed. There are many types of this treatment, that all have the same result, which is attacking cancerous cells. However, they all are completely different processes.

### a) Monoclonal Antibodies:

Monoclonal antibodies (MABs) are laboratory-produced molecules that identify and attack specific proteins on the surface of cancer cells. They can either trigger the immune system, or help the immune system attack cancer cells. The way MABs do this is by attaching themselves to proteins on the cells, which makes it easier for the immune system to identify and attack the cancerous growth. This process is called antibody-dependent cell-mediated cytotoxicity (ADCC). The MAB drugs can also be used in combination with other treatments.

### b) Cancer Vaccines:

Vaccines are normally used to proactively protect us from disease or illness. They're a weakened or harmless version of the disease they are being made to protect us from. This means that while they are a form of the disease, they don't cause it. Cancer vaccines are still being developed. However, there are currently 2 types of cancer vaccines; prevention vaccines and treatment vaccines.

- When you receive the prevention vaccine, it stimulates the immune system into action. The immune system makes antibodies that recognize and attack the harmless version of the disease. Once the body learns how to fight the disease, it prevents the virus from infecting the individual. However, the vaccine needs to be administered before the virus infects the individual. Otherwise, it will not work.
- The treatment vaccines boost the body's natural defenses to fight cancer. It is given to people already diagnosed with cancer. The vaccines may prevent the cancer from coming back, destroy any cancer cells currently in the body, or stop a tumor from growing or spreading.

### c) Immune Checkpoint Inhibitors

Immune checkpoint inhibitors are administered in the form of a drug, often made of antibodies. They allow the immune system to attack cancer cells. Checkpoint inhibitors block the normal proteins on cancer cells, or the proteins on T-cells (lymphocytes that are used for adaptive immunity) that respond to them.

## 2.3 Recent Research and Discoveries

- Chimeric antigen receptor (CAR) T-cell therapy uses a person's own cells and manipulates them in a laboratory. The T cells are genetically changed so that they'll attack cancer cells. These T cells are grown in large quantities and are injected into the patient. Fortunately, patients usually need to undergo this only once. What's even more remarkable is that this is a "living therapy." This means that the cells will multiply in the body, and usually increase in effectiveness over time.
- Oncolytic viruses are viruses that tend to infect and kill tumor cells. They can be found both in nature or made in a laboratory and reproduce efficiently in cancer cells without harming healthy cells. At the moment, they're used only to treat melanoma, with talimogene laharparepvec (Imlygic), which is the first FDA-approved oncolytic virus therapy. The treatment, which is injected into a tumor, kills tumor cells and modifies GM-CSF, a protein that boosts the immune response.

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## 4 CONCLUSION

Although other treatments like chemotherapy and radiation therapy may be more prominent, immunotherapy is the most beneficial way to fight diseases. As it's a natural process, your body and immune system will benefit greatly. Immunotherapy reduces many of the risks that other treatments cause, and scientists are realizing this too. The process is being used globally, and constantly is being developed. Other cancer treatments will soon be of the past, and immunotherapy paves its way as the new era of treating cancer.

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