

Immunotherapy: The Cancer Treatment of The Future?

Dr. James Allison and Dr. Tasuku Honjo have recently developed a new cancer treatment technique for combating cancer that may save many lives in future. Rather than administering a drug, they have found ways to use components of a patient's own immune system to seek and destroy cancerous cells.

The human immune system is very effective at destroying harmful pathogens, but has a number of regulatory “braking” mechanisms in place in order to prevent it from attacking healthy body cells. However, because cancerous cells are not invaders, but rather human cells run amok, the immune system is often unable to effectively combat them. Dr. Allison engineered an antibody to remove a key “brake” protein, CTLA-4, and thus allows the immune system's T-cells to fight cancer. Working independently, Dr. Tasuku also disabled another regulatory protein called PD-1. Human trials are now underway for treatments that block CTLA-4 and/or PD-1, thereby unleashing the protective power of the human immune system. For his groundbreaking work in cancer research, Dr. Allison received the Nobel Prize in medicine in 2018.

Amgen is currently working on identifying additional targets for immunotherapy; promising molecules that could be regulated in order to combat cancer.

Suggested Teaching Sequence:

1. Introduce Dr. Allison's immunotherapy work with [this short video](#), which was produced by the *Wall Street Journal*. The first two minutes of the film are the most crucial.
 - This video introduces Dr. James Allison, summarizes the basic principle of immunotherapy and briefly outlines the positive outcomes of Dr. Allison's work.
 - This video will also be an excellent way to preview content for ELL students and other students who might have difficulty with the reading level of the blog post.
2. Check for understanding by asking questions such as:
 - What kind of researcher is Dr. Allison? *He is an immunotherapy researcher who studies how the human immune system functions.*
 - Why was Dr. Allison hoping to find an alternative to chemotherapy and radiation? *Current treatments, such as radiation and chemotherapy, cause many side effects and are not effective in every patient.*
 - What does Dr. Allison mean when he says “we are treating the immune system, not the cancer”? *Dr. Allison's research trains the human immune system to attack cancer cells, rather than attacking the cancer cells directly.*
3. Divide students into pairs or small groups and have them read the [blog post](#) on immunotherapy.
4. Discuss the reading as a class. Check for understanding by asking questions such as:
 - Why does the body usually need proteins like CTLA-4? *The human immune system will attack its own cells, save for regulator proteins that “put a brake” on its capabilities.*
 - What is meant by “taking the breaks off the immune system”? *Dr. Allison's research led to the development of a new medication that blocks certain regulatory proteins within the immune system. These proteins normally “brake”*

the efforts of the immune system, and prevent it from attacking certain tissues. By blocking these “brake” proteins, the human immune system can be primed to attack cancer cells.

- *Summarize Amgen Senior Scientist Jackson Egen’s current work. Dr. Allison’s work discovered a single drug target, but there are many other potential options. Amgen Scientist Jackson Egen is working to identify more small molecules that might be exploited in order to treat other types of cancer.*

FAQs:

Students may ask questions such as the following.

What is cancer?

“Cancer” is a catch-all term for when cells divide far more quickly than normal, rather than a disease caused by a particular infectious organism or specific genetic mutation. It can occur almost anywhere in the body. These rapidly dividing cancerous cells often form growths called “tumors”, and the cancerous cells can metastasize to other parts of the body and cause new growths to begin there as well.

What methods does the immune system use to fight pathogens?

The human immune system is highly complex and uses many strategies that work in concert to identify, target, and destroy harmful pathogens. A few examples of important immune system structures are antibodies, macrophages, neutrophils, T-cells, and B-cells. Inflammation and increased body temperature are also effective defense mechanisms. Inflammation (swelling) can help clear out damaged cells and tissues from an area of injury, allowing healing to begin. Increased temperature denatures the proteins in the pathogens, helping to eliminate them.

Why does our immune system struggle to target cancer cells?

The immune system is excellent at attacking invaders. However, cancer cells are not a foreign body like bacteria or viruses; they are native human cells that have begun replicating dangerously quickly. The immune system is programmed to avoid attacking its own tissues, if at all possible. Because of this, the body may not recognize a growing tumor as a threat.

How does the new T-cell therapy avoid some of the pitfalls of traditional chemotherapy?

Chemotherapy drugs are powerful medications that attack rapidly dividing cancer cells. Because cancer cells divide so rapidly, chemotherapy drugs are highly effective against them. However, because many healthy cells naturally divide very quickly, chemotherapy can also accidentally kill cells in the skin, hair, gastrointestinal lining, and other areas where cells divide rapidly. Immunotherapy allows the body’s immune system to recognize and kill specific types of cancerous cells, and has currently shown promise in treating melanoma and bladder cancer, among others.

Suggestions for Differentiation:

Immunotherapy is a fascinating but complex topic, with highly specialized language. Allowing many different learners to access the material might involve the following:

1. Providing students with a glossary of key terms (such as protein, antibody, cancer cell, etc) can be a useful resource.
2. Turning on the subtitles during the video is also recommended so students can read the words in addition to hearing them spoken.
3. Providing a list of guiding questions in advance can allow students to read the blog post more strategically.

Suggested Further Reading and Resources:

[Cancer Immunologists Scoop Medicine Nobel Prize](#) *Nature*, October 2018

[How Can We Unleash the Immune System?](#) *New York Times*, November 2018

[Meet Dr. Jim Allison](#) (Video, 1:30) MD Anderson Cancer Center