The Synapse: Intercollegiate science magazine

Volume 14 | Issue 1 Article 14

2017

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Recommended Citation

Glickman, Caila (2017) "ICYMI: There's a New Way to Kill Cancer Cells," *The Synapse: Intercollegiate science magazine*: Vol. 14: Iss. 1, Article 14.
Available at: https://digitalcommons.denison.edu/synapse/vol14/iss1/14

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ICYMI

There's a New Way to Kill Cancer Cells

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In case you missed it—research oncologists around the world are treating cancer using the immune system. You, like many others not participating in oncology research, may have missed the news, but immunotherapy drugs are leading to the most recent breakthroughs in cancer history. Researchers are only now opening up this treasure chest of life-saving medicine, so things are moving quickly. No advancement of this magnitude has happened since the 1960s, when chemotherapy drugs were finally curing diseases like childhood leukemia and lymphomas. Now, cancer immunotherapy is becoming an entire field rich in revolutionary medicine and treatment of disease.

Chemotherapy and radiation are no longer the only options; treatment is becoming more targeted to focus on cancer cells and leave healthy cells to live out their days. Oncological research is now moving away from toxic drugs and focusing on exploiting the tremendous power of none other than the immune system. I spoke with Dr. Ron Peck, a medical oncologist who worked on a clinical research trial for ipilimumab, a cancer-erasing drug, so he could spell it out for us. Here's the science behind how and why these drugs are working:

Typically, the immune system uses its T-cells, a type of white blood cell, to find and destroy mutated and/or harmful cells in the body. These T-cells are the cells that your body would use to kill viruses and bacteria that are making you sick. When T-cells destroy these invader cells and fight the good fight, your body once again gets healthy and the immune system is typically turned off by a marker known as CTLA4 on the T-cell. Cancer cells, however, can hide their 'chemical ID' from the immune system, allowing the cells to divide and grow at rapid speeds without being detected. This is why they are almost impossible to stop and destroy; because the immune system fails to recognize cancer as an invader, it 'turns off' without ever targeting cancer cells. Drugs like ipilimumab are flipping that CTLA4 switch back to 'on', pushing the immune system to eliminate tumors as a result.

Research in cancer immunotherapy focuses on turning the immune system back on to target specific cancer cells. This is done by reversing those signals that would turn the immune system off. These drugs are actually called checkpoint inhibitors because they turn checkpoints (like CTLA4) back on when they would normally turn off. Since this is an atypical process for your body to go through, these 'switch-flipping' drugs need to be prepared in a lab. Biotech companies first manufacture specific antibodies, or virus neutralizers, that are extremely sensitive to the exact type of cancer marker researchers are looking to destroy. This antibody will then mark the cancer cell as an invader, revving up the immune system so the T-cell is able to detect and kill it.

This technique, however, is not novel. Over 100 years ago, it was found that patients with visually-detectable cancer who happened to also have severe infections were being cured of both issues. We know now that when the immune system is in overdrive (like when it's targeting a virus), T-cells will also target and kill cancer cells. In the 1980s, research oncologists began developing and genetically engineering proteins in an effort to target cancer cells through immunotherapy. These drugs, however, were incredibly toxic and failed horrifically. That is not to say that ipilimumab and drugs like it are perfect; there are side effects. For example, since the immune system is now working on overdrive, some patients have developed autoimmune-like diseases in which their immune system begins to attack healthy cells instead of harmful ones. This issue disappears once medication is stopped and patients are typically willing to take that risk since the drugs are essentially ridding their bodies of terminal cancer.

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Dr. Peck worked specifically with patients dealing with metastatic melanoma, a type of skin cancer which has metastasized, or

spread, throughout the body. This type of cancer, one of the fastest growing, has an average survival rate of six to nine months after diagnosis. No treatment has ever successfully prolonged survival until now.

Ipilimumab, an antibody that targets a specific receptor on T-cells to find and destroy metastatic melanoma cells, began undergoing clinical studies in 2000. In 2010, the first positive phase three study of metastatic melanoma treatment came out. This means that researchers tested the drug on patients to assess efficacy, effectiveness, and safety, and each category checked out. The study showed a prolonged survival for patients, an unprecedented result in treatments for this cancer, and led to the drug's approval in 2011. Now, seventeen years after the study first began, it's been found that about 20 percent of patients who previously had terminal cancer and less than a year to live are now cancer-free. Doctors are calling it 'long-term survival'; the word 'cured', as you may imagine, is a little taboo in the field.

While 20 percent may seem low, it's an incredible accomplishment at combating terminal cancer. Still, the question haunts research oncologists: why only 20 percent? No one knows yet. The study is only about 10 years out for data collection, and clinical researchers are hoping to find markers which can predict whether or not these types of drugs will work for certain patients over others.

More research is being done in this field than ever before. Ipilimumab has acted as the 'shoulders' for similar drugs to stand on that are a lot more effective and have a lower risk for autoimmune-like symptoms. Many oncologists who used to view immunotherapy drugs as incredibly dangerous are now hopping on the bandwagon to research more checkpoint-inhibitor drugs. The biggest advancements since ipilimumab are anti-PD1 drugs. Like CTLA4, PD1 is also a checkpoint for the immune system to be turned off. There are now five anti-PD1 drugs that have been approved in the last three to four years for seven different types of cancer.

This research is unbelievably recent and growing at rapid speeds. Recently, there was a groundbreaking approval for a new type of immunotherapy technique to treat childhood leukemia; in short, T-cells from the body are extracted and genetically engineered to hone in on leukemia cells, induce an immune response, and kill the diseased cells. This technique has been termed 'CAR-T cell therapy' and it uses genetics as a way to train the immune system.

It is obvious that the clinical research field in oncology is expeditiously improving. It is bringing in techniques and approaches from the untapped field of immuno-science. It is finally getting a grip on how to destroy metastasized malignancies. It looks like we have finally reached the breaking point and the age in which we may have a viable new avenue for curing cancer.

If you'd like to learn more about cancer immunotherapy, see the National Cancer Institute's regularly updated "Immunotherapy" page on their website.