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Opinion

Cancer Immunotherapy

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Our body is constantly under attack from deadly pathogens which includes viruses, bacteria and fungi. At the same time, a healthy human body is equipped with an army to counter-attack. This includes antibodies and white blood cells (such as T-lymphocytes) that circulate within the blood stream and neutralize foreign invaders, thus keeping us protected from disease. There are times, however, when our natural defense mechanisms struggle to fight attack and one of the classic cases where this occurs is cancer.

Immunotherapy: Immunotherapy is the prevention or treatment of disease with substances that stimulate or suppress components of the immune system. There are four ways in which immunotherapy is being tried at present. These are the following:

- **Monoclonal antibodies**: These are man-made versions of immune system proteins. Antibodies can be very useful in treating cancer because they can be designed to attack a very specific part of a cancer cell. Antibody treatment can be administered in two forms, either "naked" or as a radio or chemo-conjugate.
- **CAR-T cell therapy**: CAR-T cell therapy is a personalized therapy conducted by re-engineering a patient's own T-cells. In this treatment paradigm, T-lymphocyte cells are taken from a patient's blood. These are then engineered in the laboratory so that they specifically target and destroy the patient's cancer cells. This is performed by adding a special receptor to the cells called a chimeric antigen receptor (CAR). A large number of these engineered T-cells, now called CAR-T cells, are grown in the laboratory and re-introduced into the patient's body by infusion.
- **Immune checkpoint inhibitors**: It is very important to control the immune system cells or the body's "policemen" from destroying their own. Therefore, a check has to be incorporated so that the immune system attacks hostile cells only while leaving the native cells alone. There are two known proteins (PD-1 and CTLA-4) that function as a 'brake' of the immune system. Unfortunately, the tumour cells use this braking mechanism to their advantage. Immune checkpoint inhibitor drugs basically take the 'brakes' away from the immune system, which unleashes an attack on the cancer cells.
- **Cancer vaccines**: These are vaccines that boost the weary immune system in a selective manner. Most cancer vaccines rely on administration of a marker that is over-expressed on the surface of tumour cells. By introducing the cancer-specific marker, the immune system is trained to identify and attack anything that expresses that particular marker. This is an extension of the basic principle of attenuated vaccines, such as the measles or the polio vaccine, that have been successfully administered to children all over the world since decades. There are examples of cancer vaccines that are administered along with checkpoint inhibitors, a therapy called combination therapy.

This year, the Nobel Prize for medicine went to scientists Dr. James Allison and Dr. Tasuku Honjo for their groundbreaking discovery of cancer therapy by inhibition of negative immune regulation. Dr. Allison studied a known protein called CTLA4 which essentially serves as a brake on the immune system in order to control autoimmune diseases. Going against conventional belief, he conceptualized on releasing the CTLA4 brake and thus unleashing the immune cells to attack tumours. In parallel, Dr. Honjo discovered a protein found on T-lymphocytes called PD-1 that also serves as a brake on the immune system. Therapies based on his and Dr. Allison's discovery proved to be highly effective in the fight against cancer. Their work is truly a paradigm shift in cancer therapy where a rejuvenated immune system takes up the battle and fights against tumour cells.

Cancer immunotherapy is an exciting, relatively new, field that has the potential to save millions of lives; and this is just the beginning.

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