**Cancer Synopsis New Cancer Defense Essay Marcus Stevens February 9, 2016**

In June of 2004, a young lady was diagnosed with metastatic melanoma in her lungs. This was immediately treated with chemotherapy, but over the course of two years, her brain slowed and immune system couldn’t stop the tumors’ spread. However, a newly developed innovative medicine designed to enhance the immune system’s capabilities to fight against cancer was given to her. Sure enough, after four treatments, the melanoma was obliterated. This revolutionary therapy in the field of cancer treatment validated many years of hope that scientists could develop powerful cancer therapies that set the body’s own immune system against its own malignancies. Optimism has grown over the years in the science community as they have learned about similar successes with detrimental cancers using immunotherapy treatments.

The notion that the immune system could control cancer is not new, and attempts to uncover this date back to the early 1900’s. William Coley, a former surgeon at the New York Cancer Hospital, attempted to use heat-killed bacteria for this purpose. He noticed a common trend in survival when they developed an infection after their cancer surgery. “Coley hypothesized that the intrinsic defense system that had been mobilized against the pathogen could also affect the tumor.” In the following decades, scientists have how the immune system mobilizes rapidly to find potentially infectious pathogens. Researchers have also found the many signals that tell the immune system that it has reached its limit in order to prevent unnecessary destruction of normal tissue.

When the immune system is working properly, both of its general and adaptive branches cooperate to eliminate threatening pathogens. However, when it is not working, due to cancer, the cancer actively dampens the immune system’s responses to malignancies and shuts off vital switches of the immune system. New approaches have attempted to disable those internal immune system brakes.

CTLA-4 is a protein present in many kinds of T cells (cells of the adaptive defense system). This protein, when activated by the T cell, is able to work like a series of molecular brakes or checkpoints that prevent the immune system from becoming overly destructive. The lack of these checkpoints can be detrimental to an organism. For example, mice that were genetically engineered to lack the essential CTLA-4 died within three to four weeks. In light of this study, James Allison, at the University of California, Berkeley, hypothesized that if the CTLA-4 was temporarily disabled, the immune system would subsequently attack the tumor more vigorously. After a series of studies, it was true that blocking CTLA-4 resulted in a regression of several types of tumors. They then developed a CTLA-4 blocking antibody called ipilimumab.

It is fairly hard to tell how well a patient is doing when treated with immunotherapies. For example, more time has to be allowed for the immune system to become more acclimated. The results of the CTLA-4 blocking antibody varied. Some patients were clearly better, while others had their tumor enlarge. That is why it is so hard to decipher the progression when using immunotherapies.

PD-1, another immune system breaking molecule, can compel the cell on which it is found to destroy themselves. Scientists have now developed PD-1 preventing antibodies, this is also a relevant immunotherapy that blocks various tumors from inducing PD-1 mediated suicide. Research has found, however, that since PD-1 and CTLA-4 immunotherapies are so closely related, they are more effective for fighting cancers when they are combined. This is their optimal form, and studies have shown that over 50% of patients treated with the combined form have seen significant results.

In all, it is now believed that it is time to start thinking about long-term remissions and cures. We now have standard immunotherapies that can be combined to target a tumor with the best of the patient’s own abilities.