The Role of Animal Research in the White House’s Cancer Moonshot

During his recent 2016 State of the Union Address, President Barack Obama took aim at cancer. Promising to “make America the country that cures cancer once and for all,” the President tapped Vice-President Joe Biden to lead the national effort that will focus on immunotherapy, genomics, and combination therapies to “make a decade worth of advances in five years.”

While animal research is an essential part of biomedical research, it plays an even bigger role in the fight against cancer. What follows are highlights of some of the most promising discoveries and therapies.

Immunotherapy Drug Development

Immunotherapy is a form of treatment that recruits a patient’s own immune system to fight cancer. Recently, genetically modified animal models have led to a host of effective new immunotherapy drugs.

Glioblastoma Multiforme (GBM) is the “most dangerous and aggressive” type of brain cancer. A diagnosis means a median survival time of 14.6 months. Current therapies, such as specialized chemotherapy, can add 2.5 months to survival, but they only work for less than half of GBM patients.

Immunotherapy offers much promise in treating GBM cancer by modifying the immune response in a way that slows or stops the spread of cancer cells. Current immunotherapies for brain cancer fall into ‘six broad categories’; cancer vaccines, checkpoint inhibitors, oncolytic virus therapy, adoptive cell therapy, adjuvant immunotherapies, and monoclonal antibodies.

Several new immunotherapies targeting GBM promise to increase the survival rate. One, Rindopepimut, recruits the immune system to attack cells harboring a specific protein that only appears on the tumor. Once clinical trials are finished we will learn all of the animal models used to develop Rindopepimut – public data at present shows that researchers used mouse models in the early phases of creating the drug.

Mice are not the only animal helping to advance GBM research – dogs, zebrafish and fruit flies are also important models of the disease. Dogs have a long history as a valuable partner in cancer research. Dogs can develop spontaneous GBM in a manner similar to people. Researchers are currently giving dogs who have developed GBM cancer spontaneously cutting-edge immunological treatments with the hope of extending their lives and gleaning insights into fighting GBM that could also help people. The University of Minnesota operates a program that has treated over 150 dogs and advanced therapies for both dog and human cancer.

There are also impressive immunological approaches being used to treat other forms of cancer. Nivolumab, commercially known as Opdivo, is a drug that helps the immune system’s T cells fight cancer in the body. Results have improved on prior treatments; some patients with highly advanced melanoma have even had their cancer eliminated entirely.

Development and testing of Nivolumab used animal models extensively. Much of the research relied on genetically modified mice, known as PD-1 knockout models. Other animals used include rats, rabbits, and cynomolgus monkeys.
Cell-Based Therapy

Cell-based cancer therapy is a unique strategy wherein a patient’s own T cells are collected from his or her blood and genetically manipulated to be more effective cancer fighters. In CAR T-Cell Therapy, the T cells are modified to recognize certain proteins that appear on cancer cells, then loaded back into the bloodstream, where they go to work to kill cancerous tumors.

CAR T-Cell Therapy was created and refined by scientists using mice, dogs, and monkeys. The research with dogs led researchers at the MD Anderson Cancer Center to develop CAR therapy for dogs with leukemia. In September of 2015, scientists announced that they had developed and tested a cell therapy that cured glioblastoma in half of the mice treated.

Epigenetic Therapy

Epigenetics is the study of cell traits variations that are not caused by encoded DNA but rather by external and environmental factors that can switch genes on or off and affect how a cell reads genes. Epigenetics is what allows stem cells to become specialized types of cells, but may also lead to cancer. Recently, researchers have developed increasingly successful drugs by targeting epigenetic enzymes that regulate the cell. Most cancer treatments seek to kill the cancerous cells; epigenetic drugs make the cancerous cells return to their normal state.

One of the most successful epigenetic drugs, called AG-221, recently put 25 out of 45 patients with acute myeloid leukemia (AML) into remission with minimal side-effects. AG-221 is still in FDA testing, so all of the species of animals used are not yet publicized, but it is known that mouse models were essential to the drug’s development.

Research in Metastasis

Metastasis is the process that causes some cancer cells to break off from the original tumor and take root in a different tissue. Metastasis causes nine out of ten deaths from cancer and there have been few advances in survival rates.

Years of research have led scientists to a better understanding of metastasis. They have identified genes and pathways that drive the spread of cancer and discovered survival methods it uses – and which may be turned against it in future therapies.

Animal models have played a large role in advancing metastasis research. Scientists at Cold Springs Harbor Laboratory used new techniques to create an advanced mouse model of metastatic prostate cancer. By precisely mimicking aspects of the illness, the mouse model will allow scientists to investigate the causes of the disease while also testing new therapies to treat it.

Similar specially-bred mouse models are also used in studying metastatic breast cancer, bone metastasis, and colon cancer metastasis, to name just a few.